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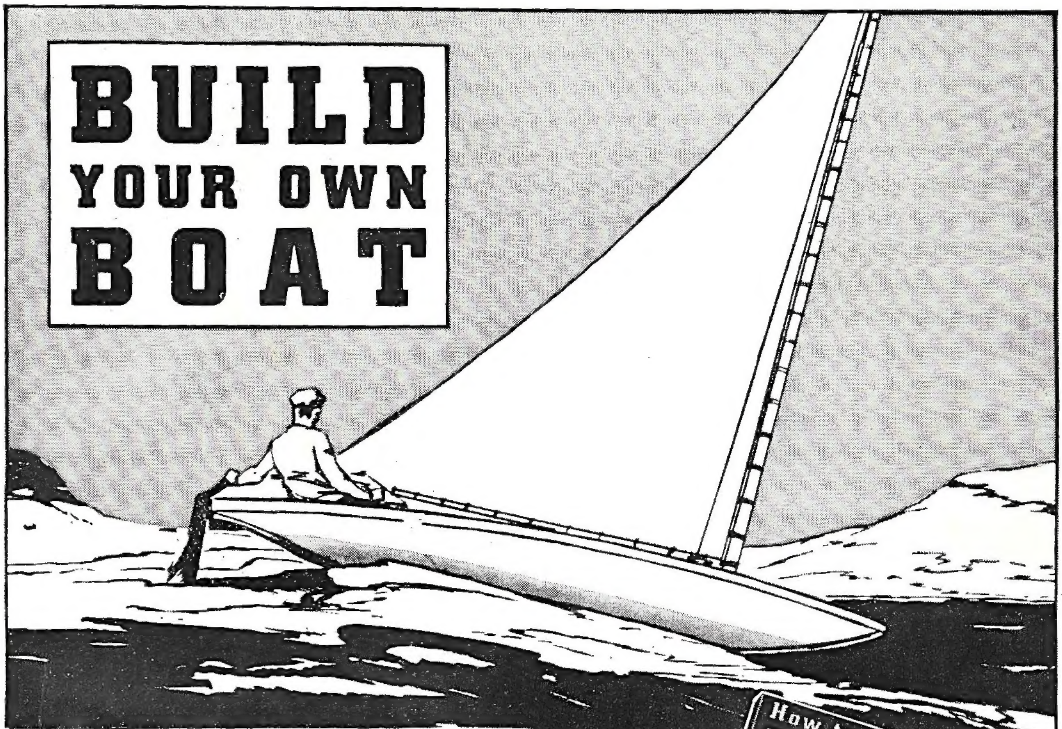

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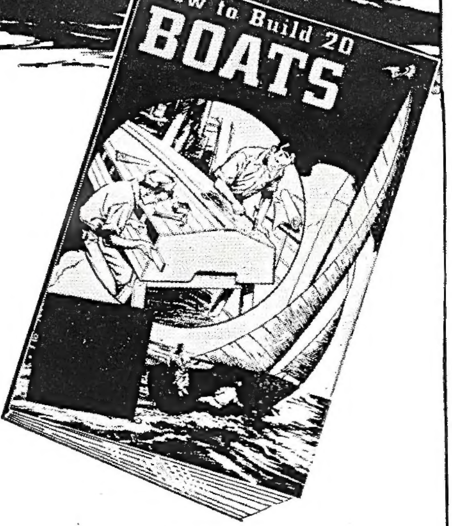

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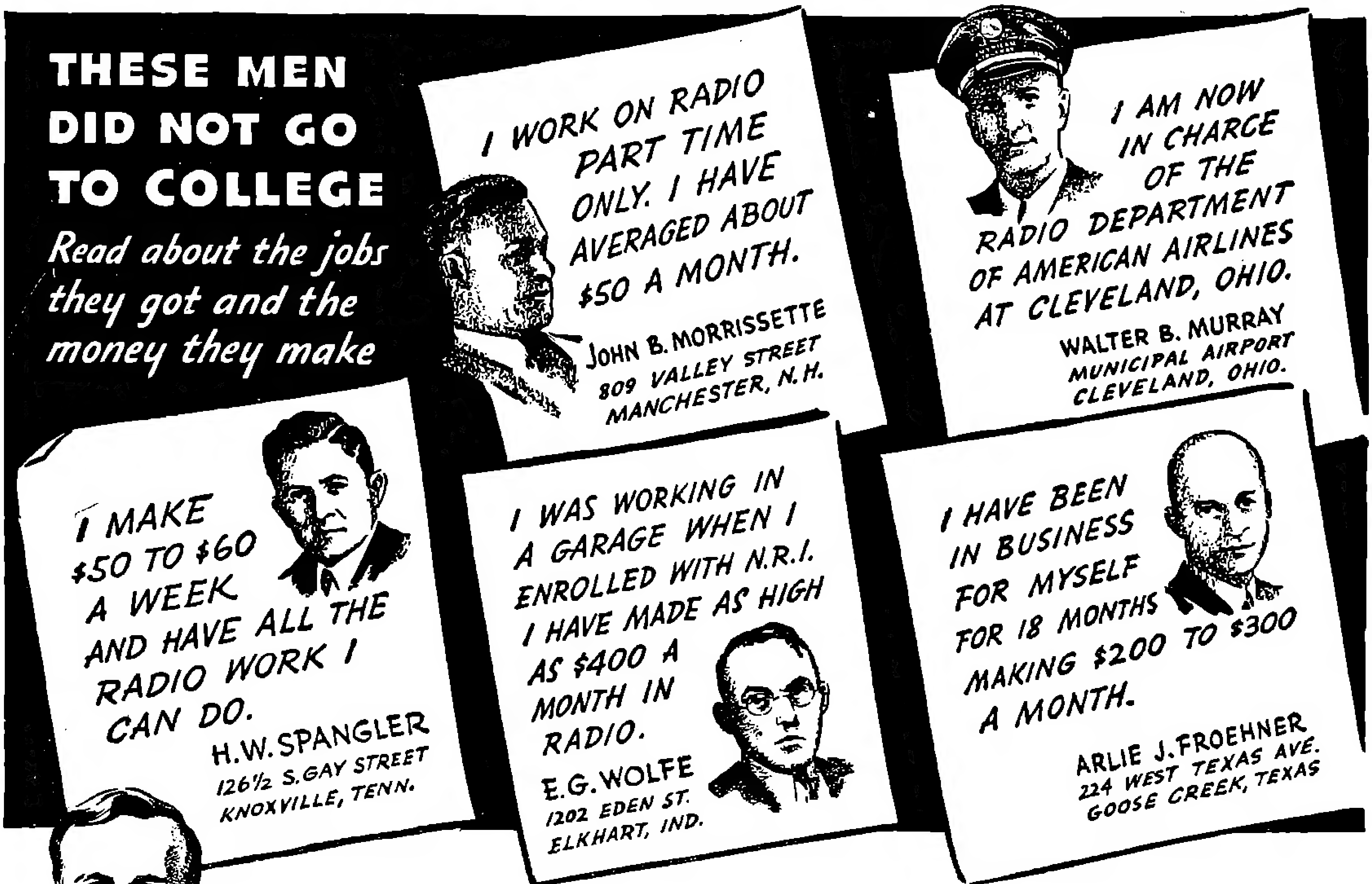

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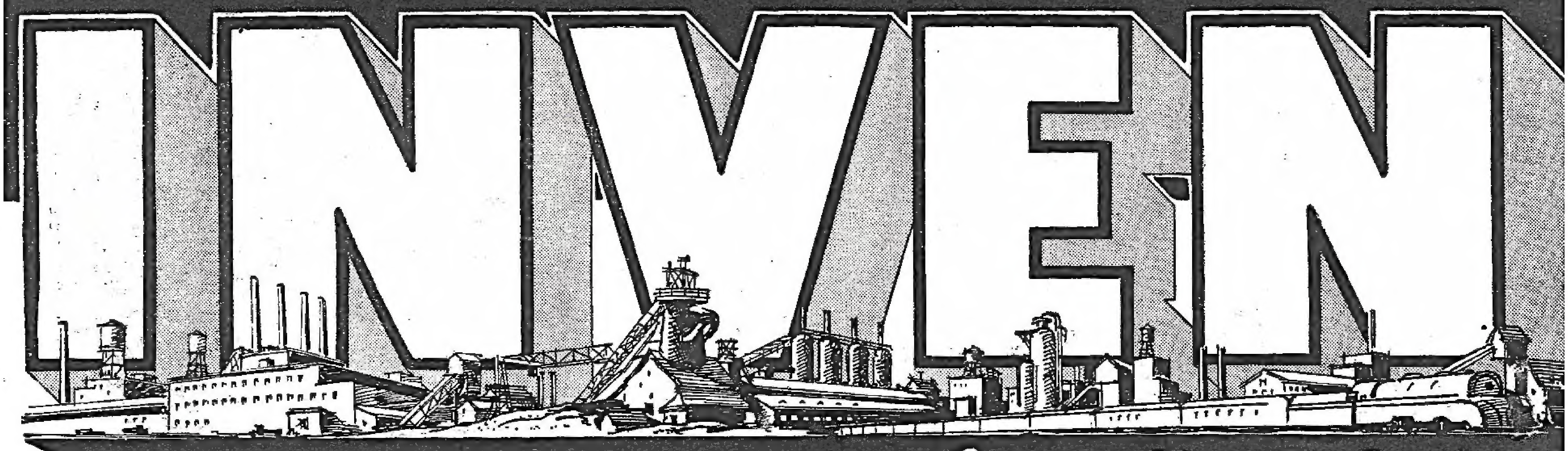

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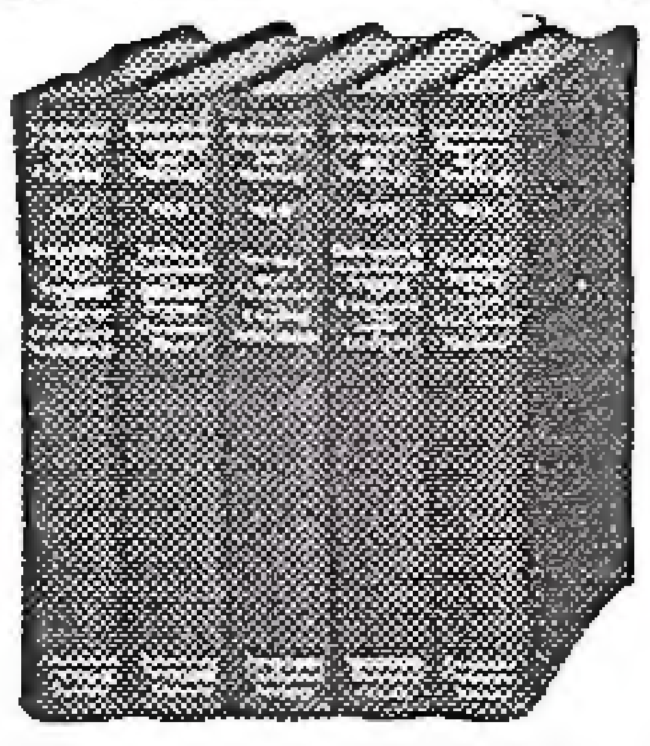

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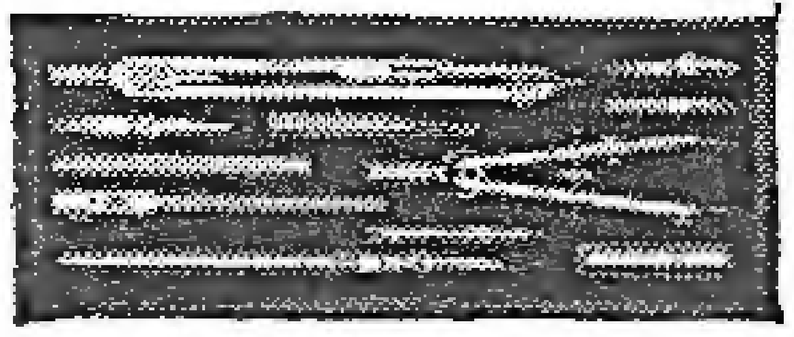

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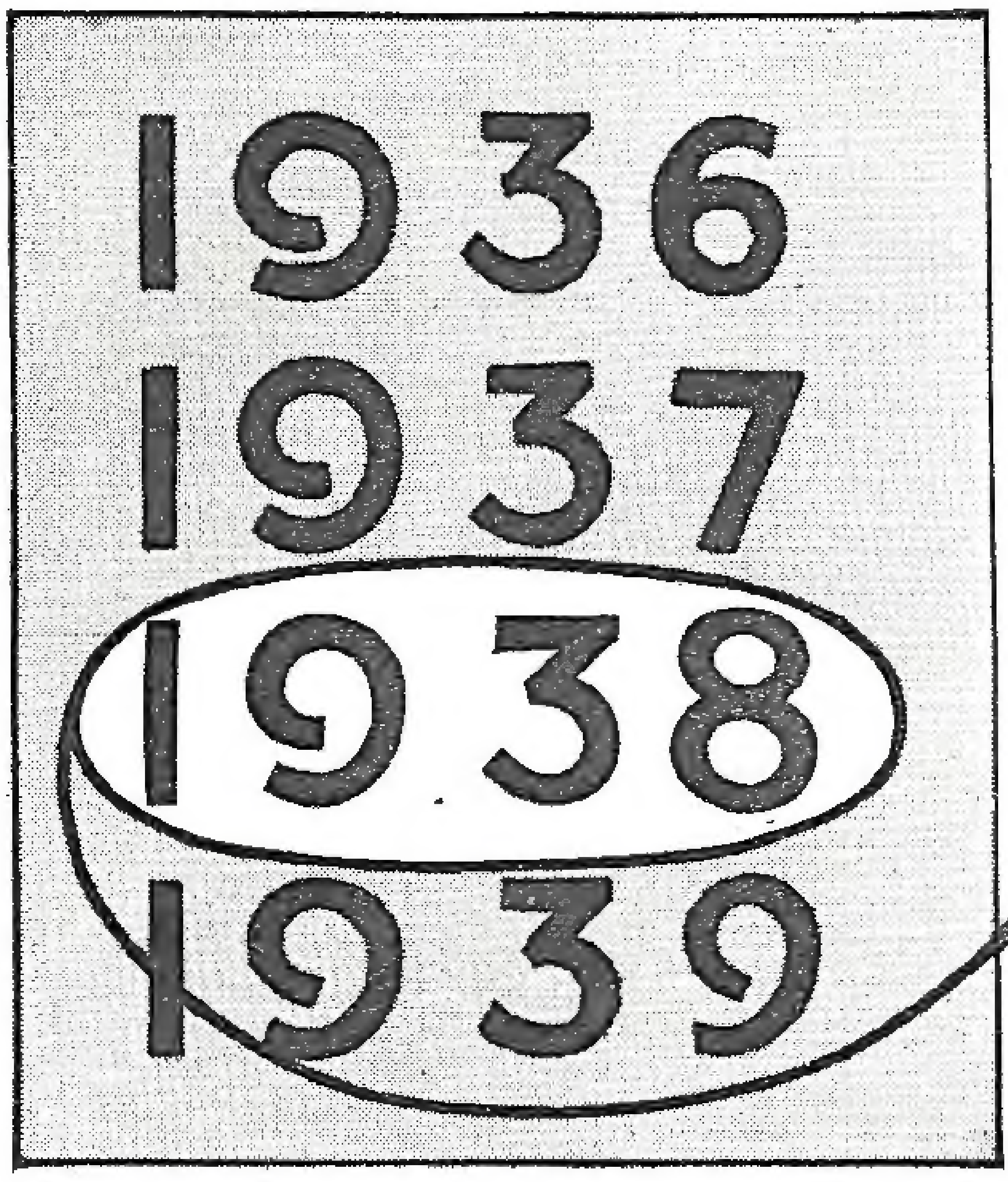

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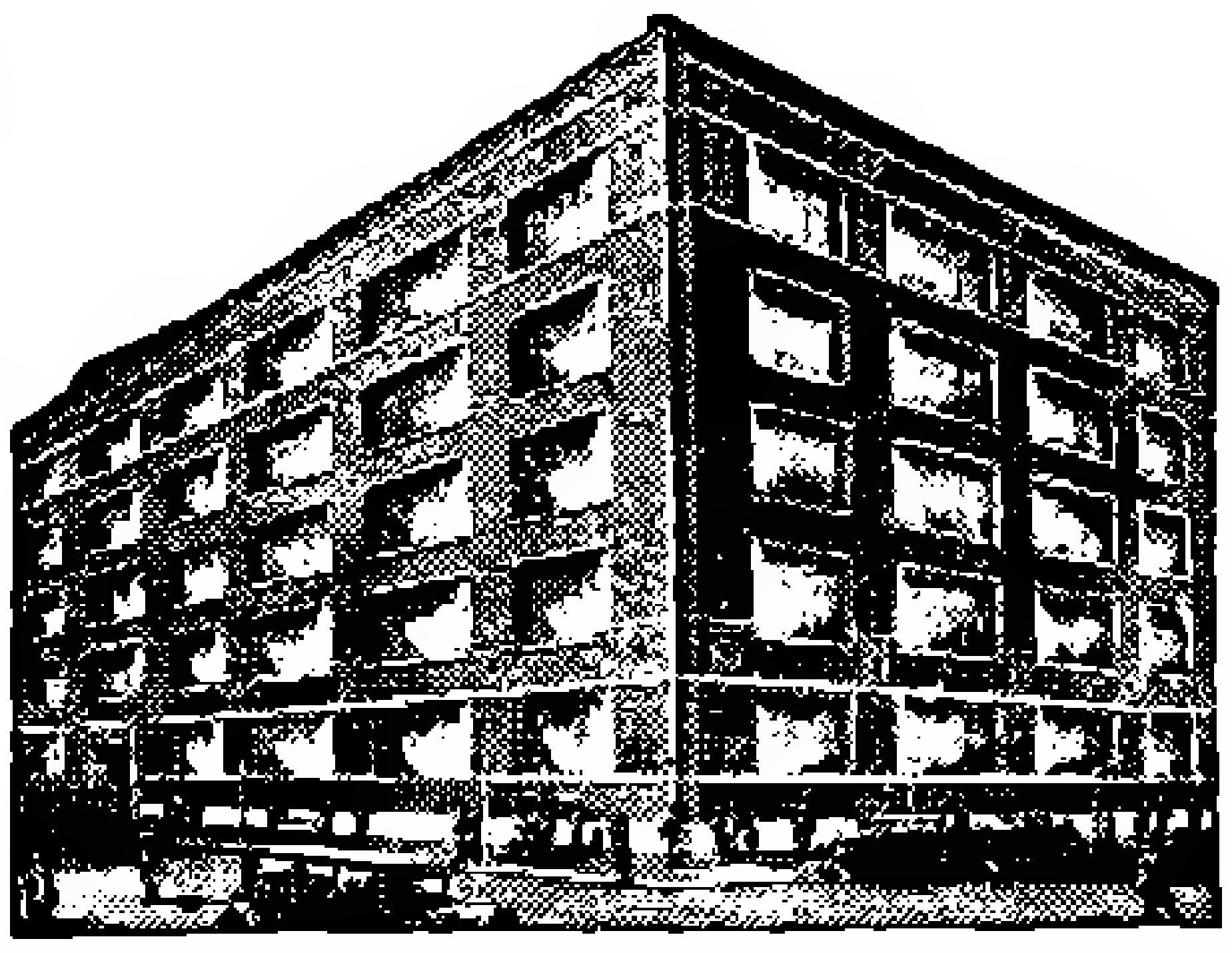

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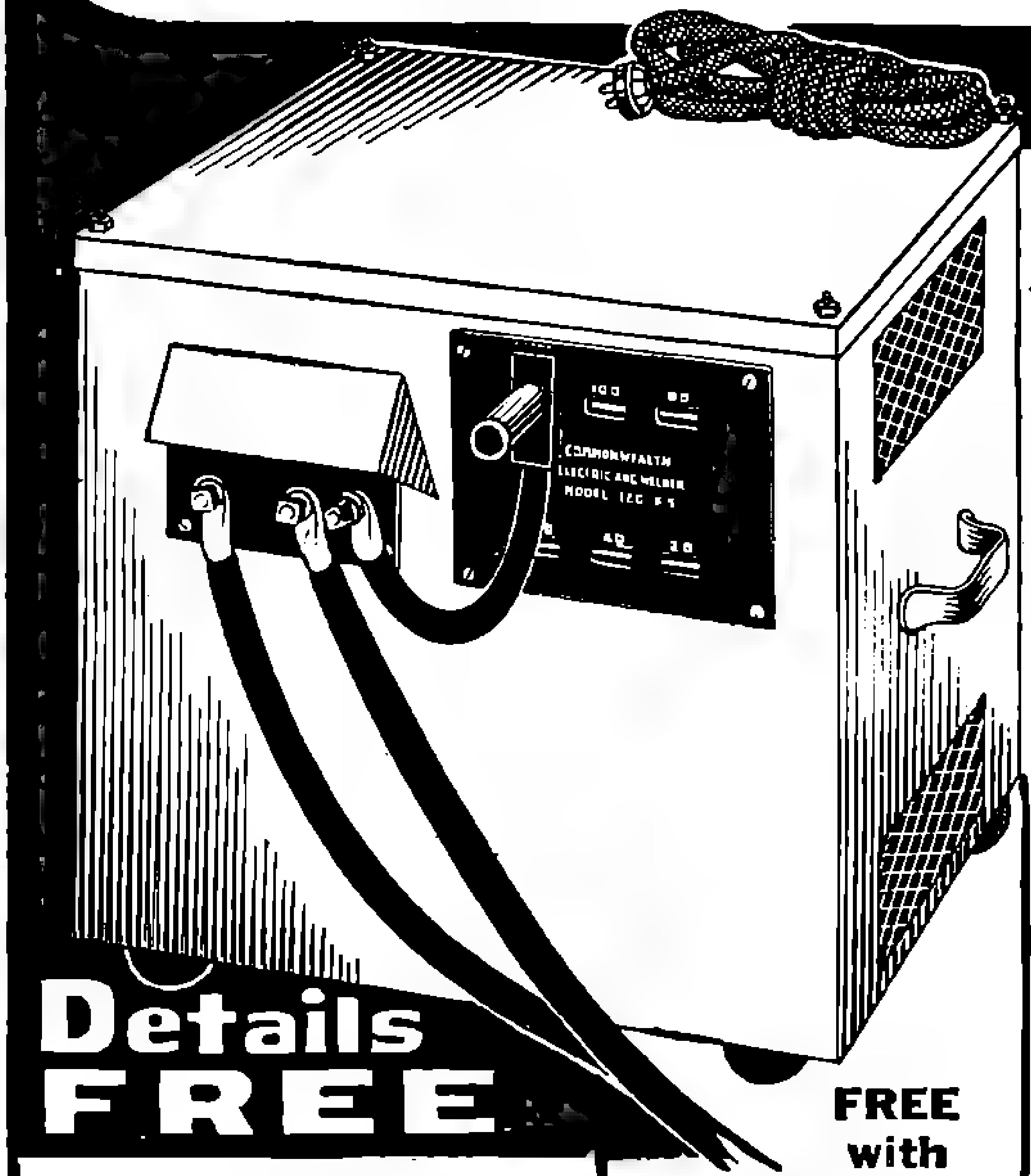

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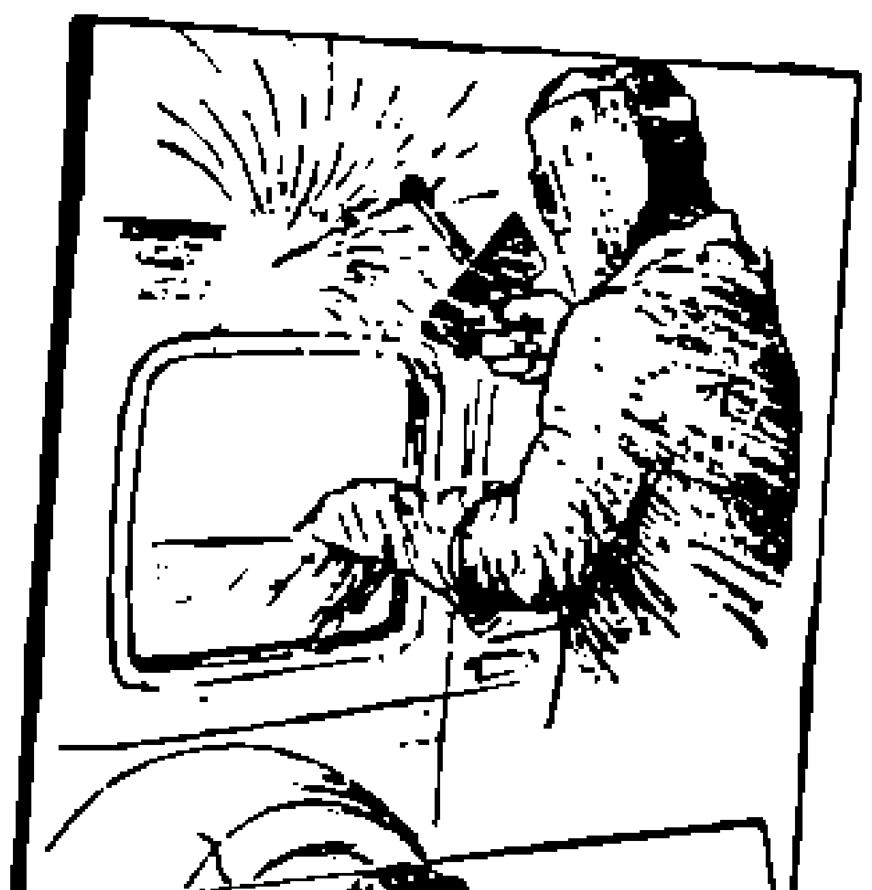

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A frank man to PATENTS-INVENTIONS

THE world of invention moves on. About a hundred years ago people were saying, "There's nothing left to invent"—today we know that is one of the funniest things ever said. Just think what has happened in the last hundred years! Autos, radios, airplanes, and thousands of useful, practical devices for home, shop and office have been invented and put on the market. Inventors are constantly making the world a better place to live in. Did you see a notice in the paper that an obscure worker, Hans Wach, has invented a simple device to utilize exhaust steam on steam boats. *Already, the report states, the steam ship lines have saved more than $15,000 in fuel bills with his invention.* Almost in the same breath the Dept. of Commerce announces that it will soon test out a new non-crashable aeroplane, which the average man can learn to fly in a day, which will travel at 110 miles an hour and sell at the price of a cheap automobile. An unknown Seattle man has invented a robot to go 5,000 feet under the sea and recover millions and millions of dollars worth of gold lying at the bottom of the ocean since the days of the early Spaniards.

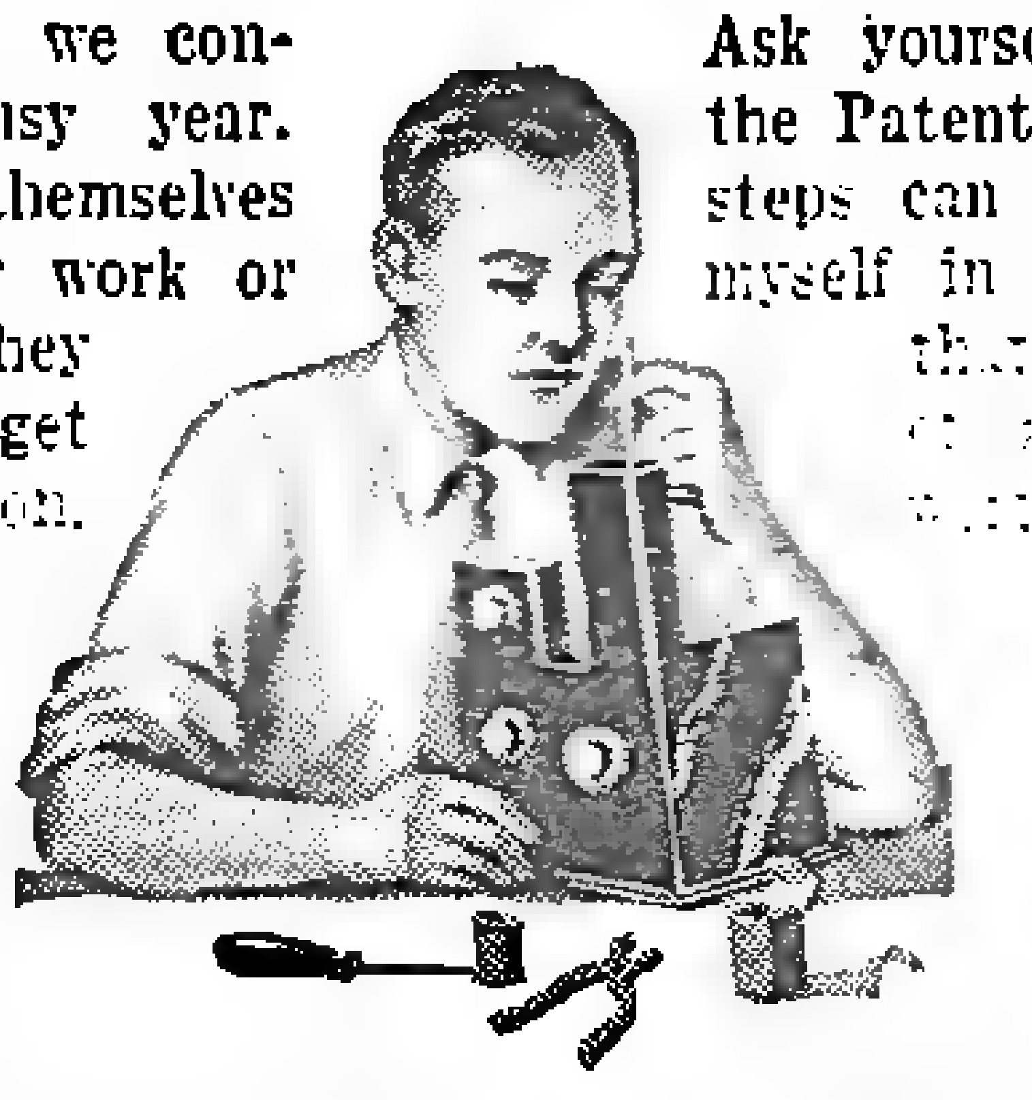
Remember this: For every outstanding big invention there are thousands of small, simple things for use in the home, the office, the factory, on the farm, on every sort of travel conveyance. Little articles like you find on the counters of a 10-cent store, hardware store, drug store, toy and novelty shop.

Many Little Ideas Have Big Commercial Possibilities

A person finds something he's using doesn't work right, or it's clumsy, or costs too much. He gets a happy thought. He improves the old Article. That's contribution to human progress. That's the way that many, many men have reached the goal of financial comfort, independence and even wealth. Most of the things millions of us use didn't come from the brains of engineers and physicists. They came from the mind and maybe the crude home work bench of Mr. Average Man, busily engaged in earning his bread and butter at whatever chance or circumstance has given him to do. The "little" man's opportunity as an inventor was never greater than it is today.

Who Are Inventors?

You'd be amazed at the men we contact in the course of a busy year. Most of them do not consider themselves inventors at all. During their work or leisure they get an idea. They work it out on paper. They get in touch with us about Protection. Did you know that a dentist invented the stock ticker, a school teacher the telephone, a farmer the typewriter, an artist the telegraph? Did you know that the crinkly hair pin—sold by millions now—came about because a husband saw his wife twisting the old-fashioned straight hair pin to make it stay in place? **Poor men who have no thought of invention now will be financially well-fixed in a few years because of a happy thought that the world could use to advantage.**



Can You Answer These Questions?

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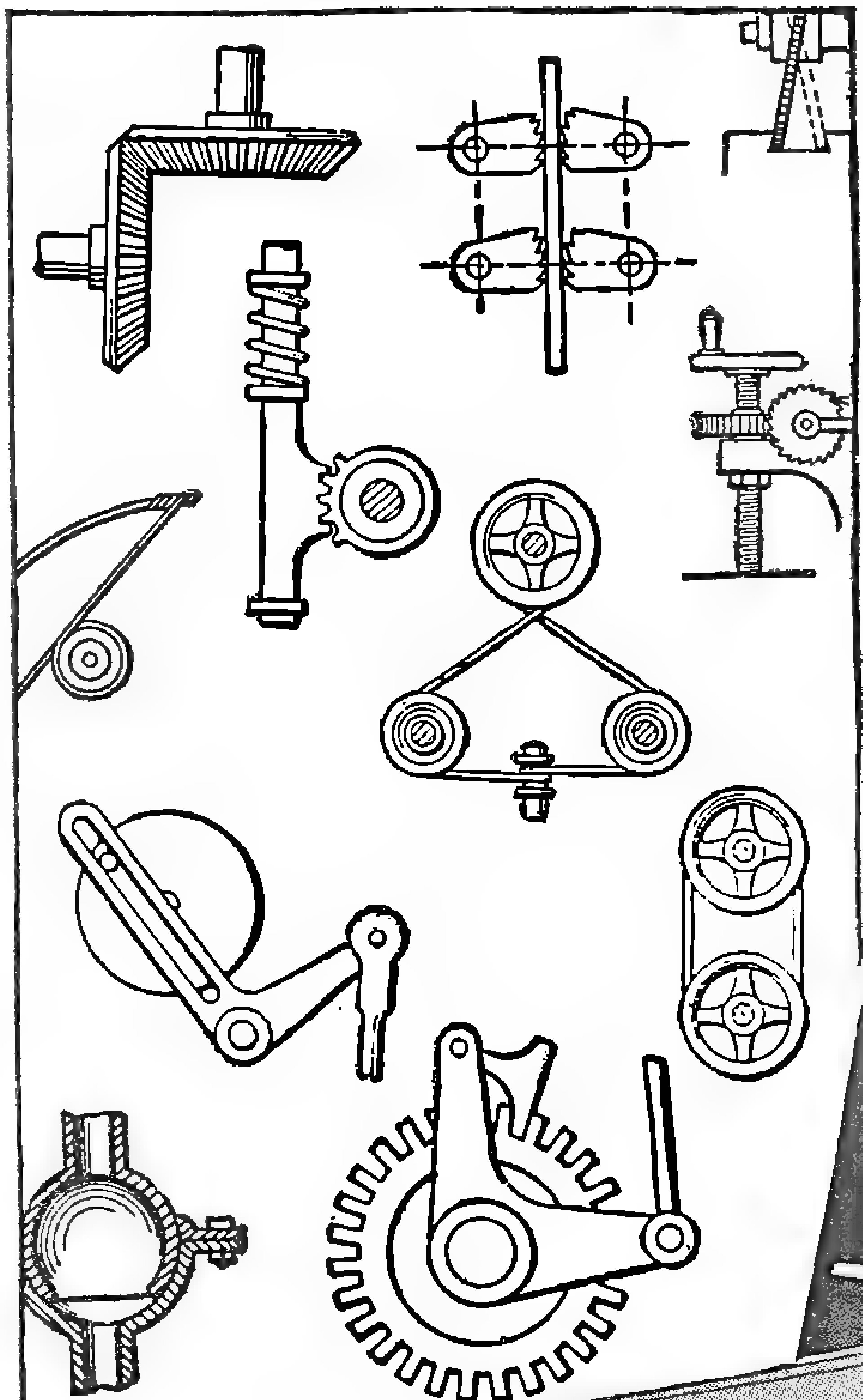

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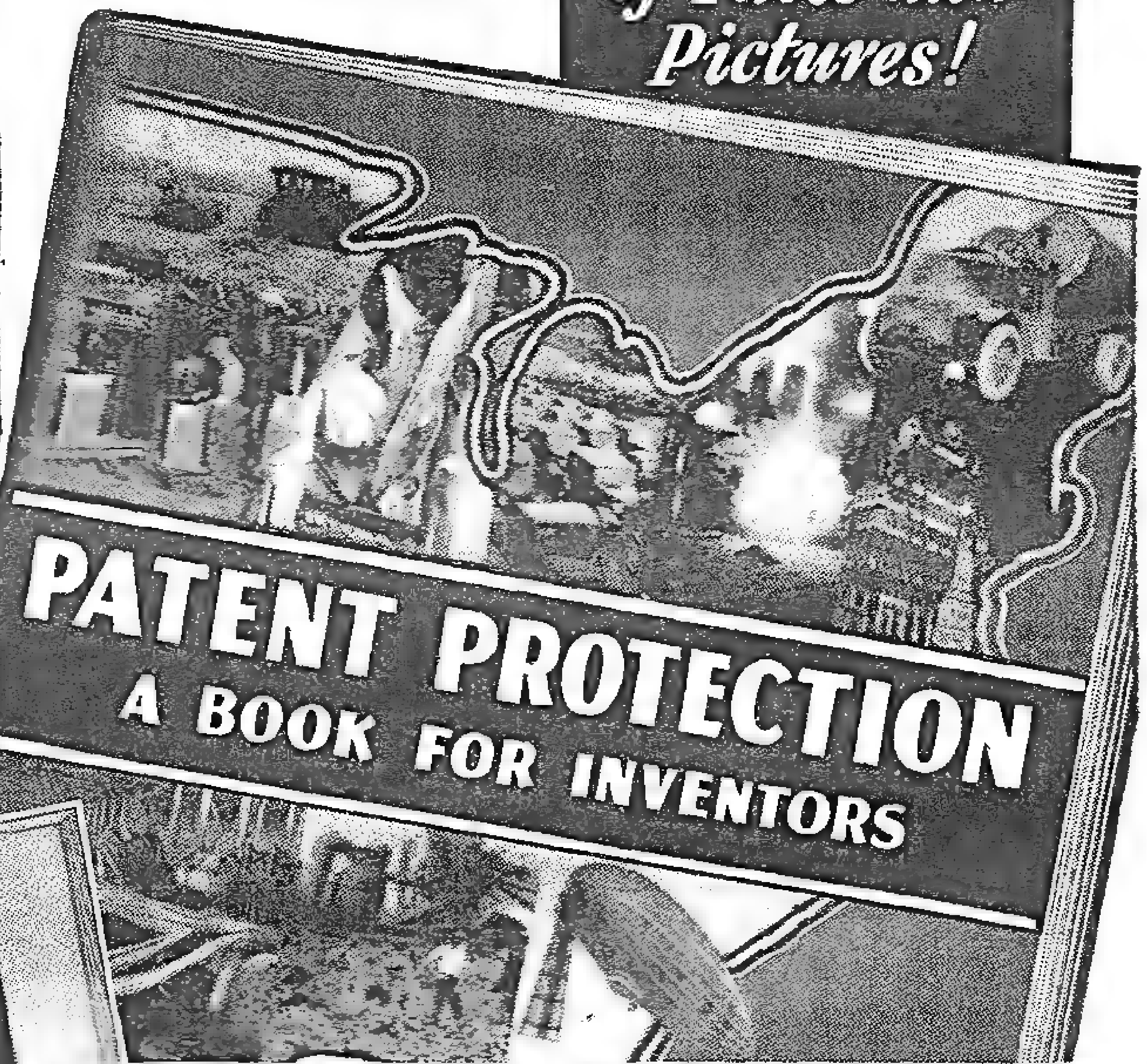

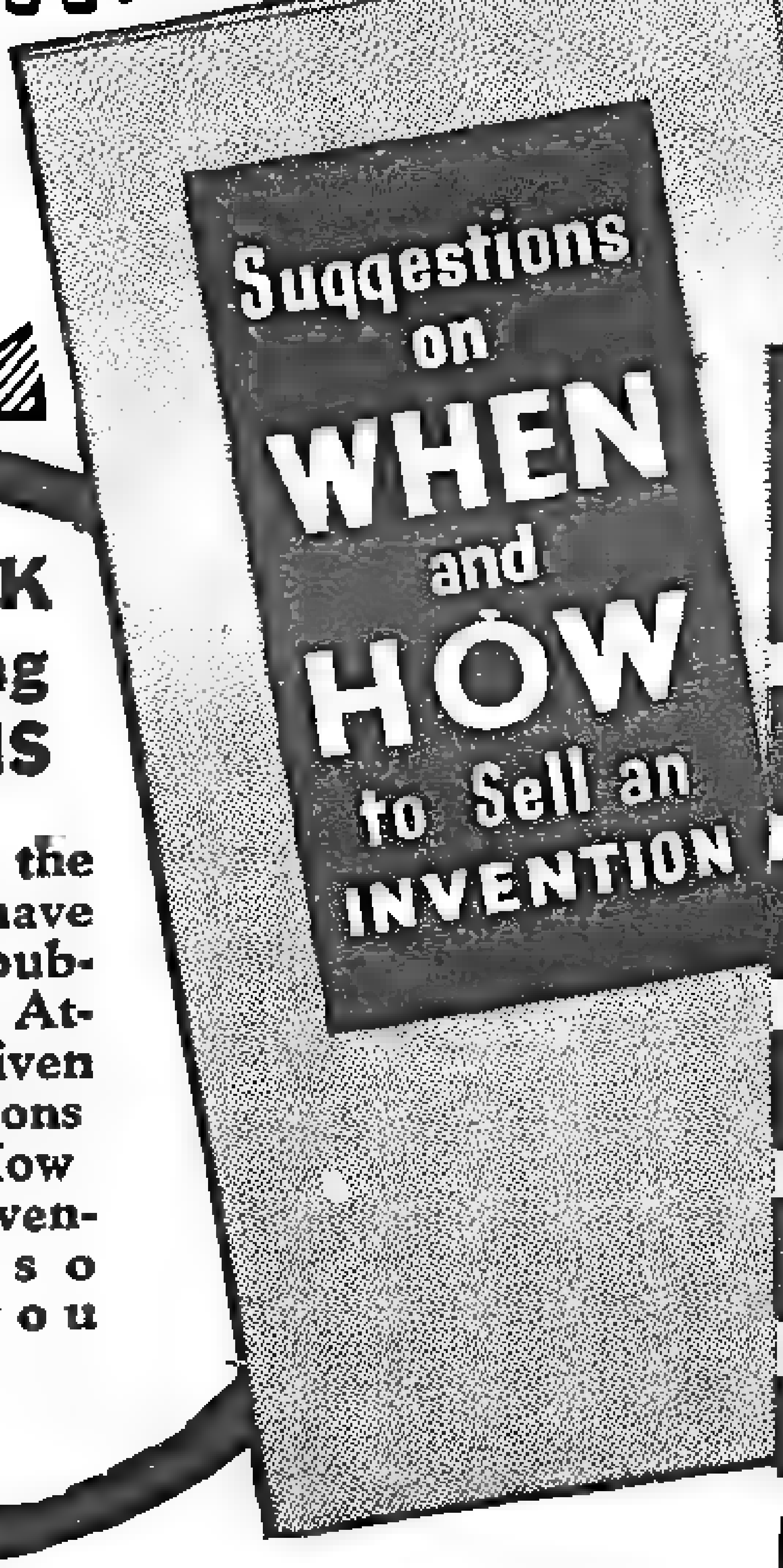

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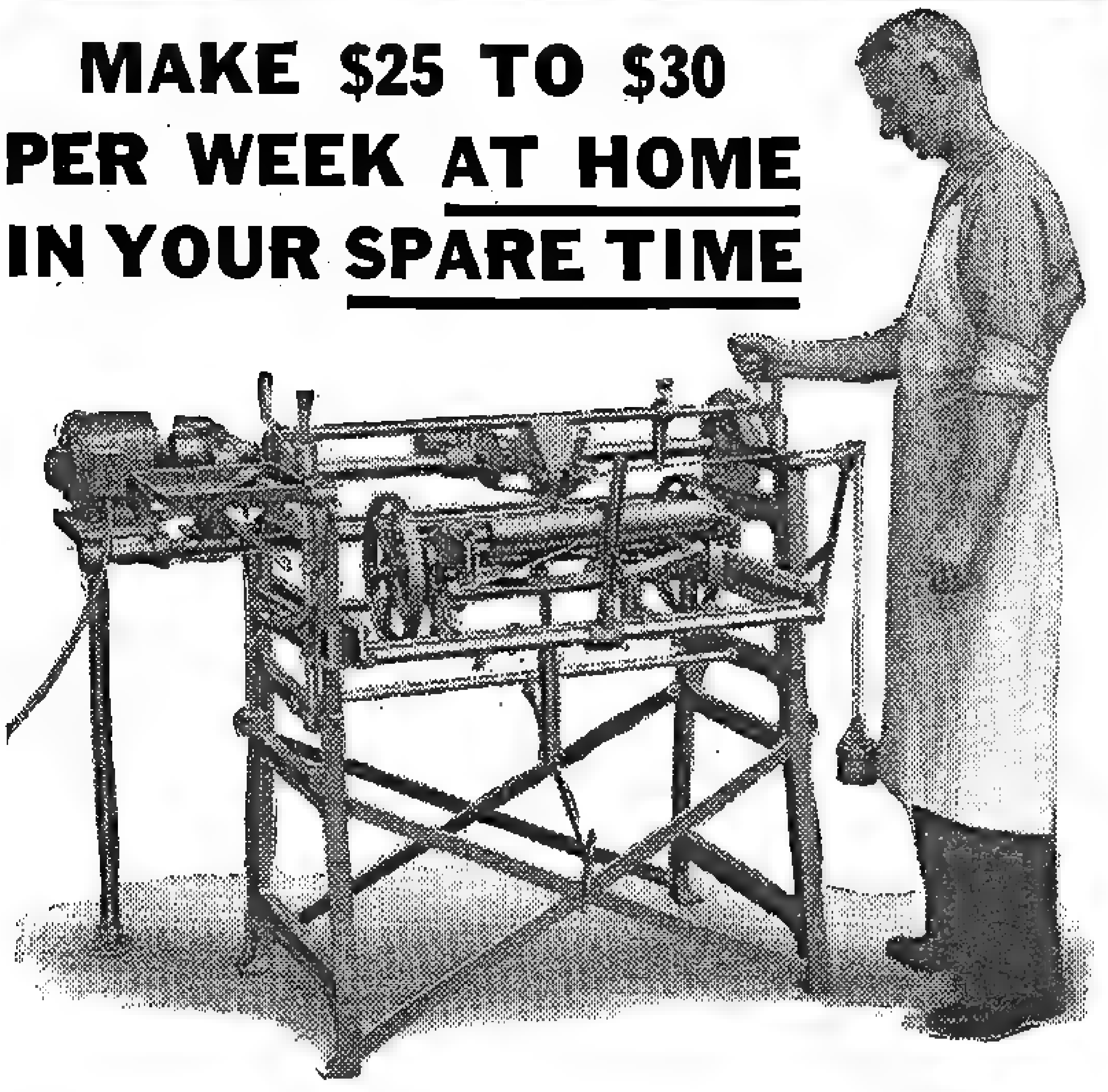

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Earth's Core A Sponge?

The earth's heavy core as a great metallic sponge filled with hydrogen gas is the latest picture of the mind of science to envision what the center of the earth is like. The Rev. Joseph Lynch, noted seismologist of Fordham University here, advances this idea in a new hypothesis.

The speed of transmission and the reflection and bending of earthquake waves, says Father Lynch, are about the only ways by which science can conjecture on the nature of the core of the earth deep below the outer solid, rocky crust.

With samples naturally unattainable, scientists must work backward in their deductions. They ask, points out Father Lynch, "what known conditions must the state of the earth's core satisfy?"

For one thing the earth has a density averaging about 5.5, or five and a half times as heavy as water per unit volume. But the density of the crust of the earth is only 4.2, so that the core requires something—liquid; solid or gas—whose density is close to the value 12. Iron, nickel and other heavy metals have previously been suggested to explain this high density, says Father Lynch.

But a study of the way earthquake waves travel through the earth shows evidence which demands other properties besides more heaviness. Tidal phenomena require that the rigidity of the core be appreciably less than that of the crust on whose surface man builds his cities that earthquakes occasionally destroy.

In addition the core must have the property of absorbing a special type of wave motion called shear waves, for it is observed that while compressional waves easily pass through the core, there are few known cases where the shear waves come out, once they are inside.

Experiments in his laboratory indicates Father Lynch, show that when the metal element palladium is packed, or occluded, with hydrogen gas to several times its own volume, its properties begin to approach those comparable with what is observed in the earth.

Father Lynch disclaims the idea that he believes the center of the earth to be made of palladium (whose value is about $18 an ounce). He merely used the rare metal as a convenient experimental sponge for "holding" the hydrogen.

The findings are suggestive, however, of the metallic sponge hypothesis on the nature of the earth's core. Experiments are now under way to study the effect of the absorbed hydrogen on the elastic properties of the material. When known these properties can be correlated with those observed in the earth and additional confirmation or rejection of the hypothesis will then be possible.

NOTICE

Changes in the make-up and title of this magazine, designed to make your favorite publication better than ever before, will be announced in our next issue. Be sure and reserve your copy now.

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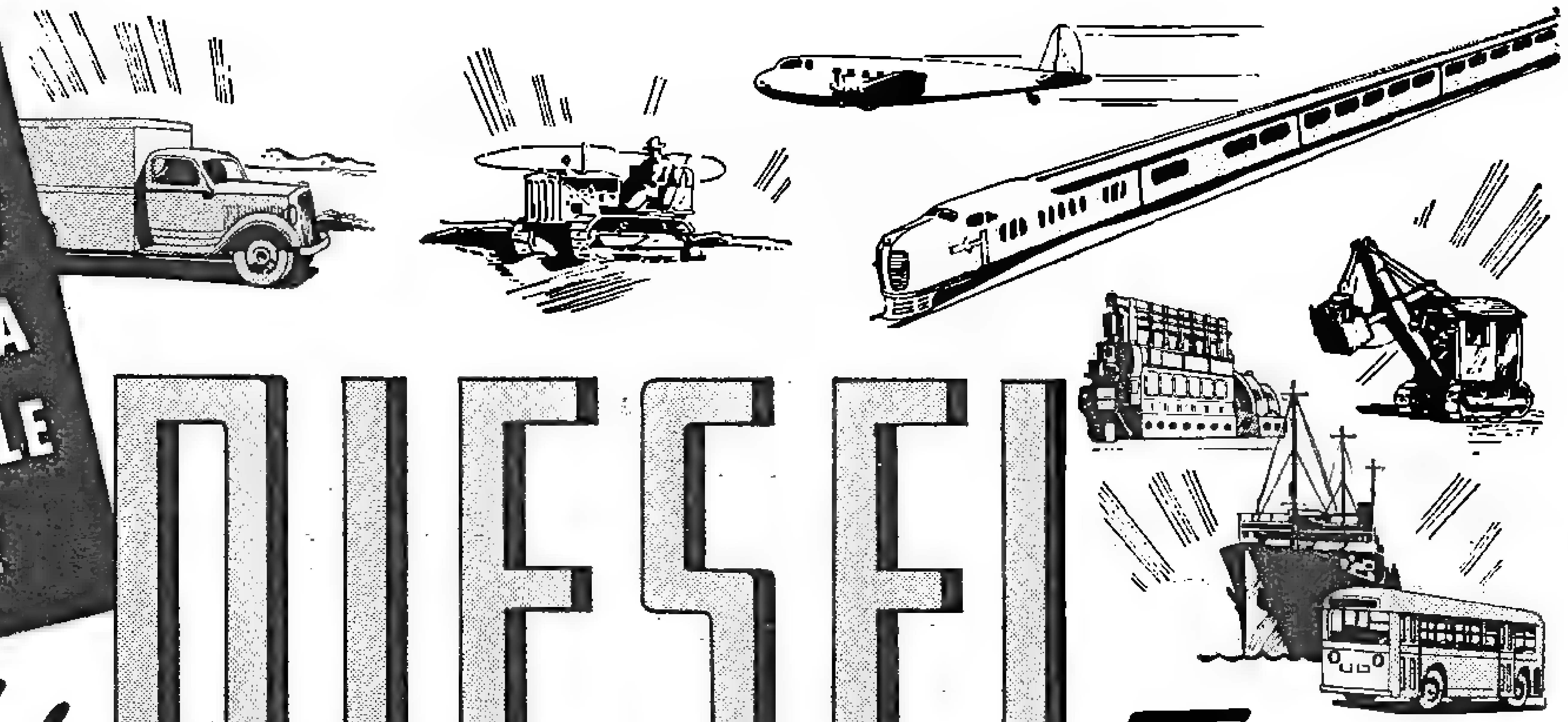

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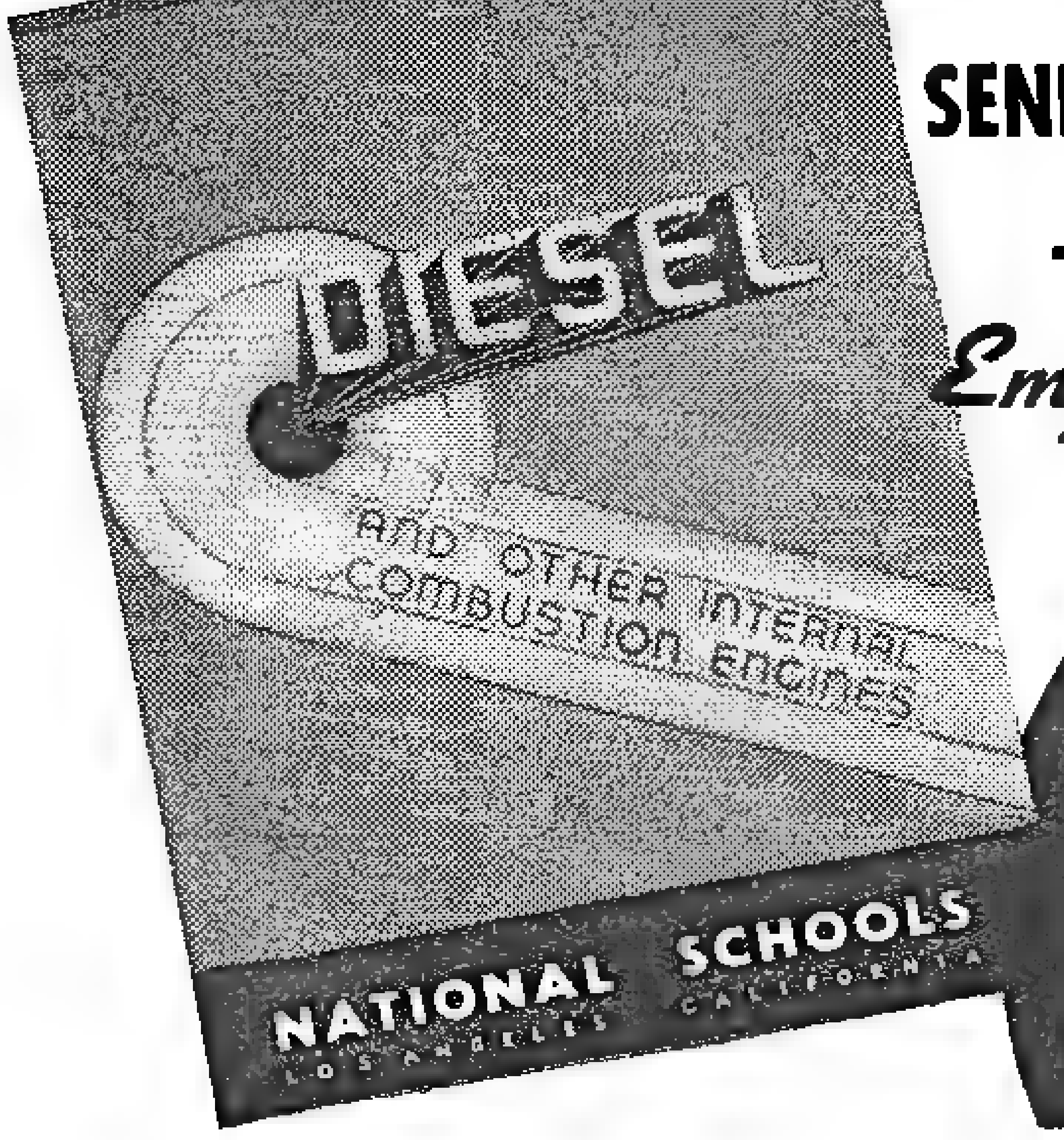

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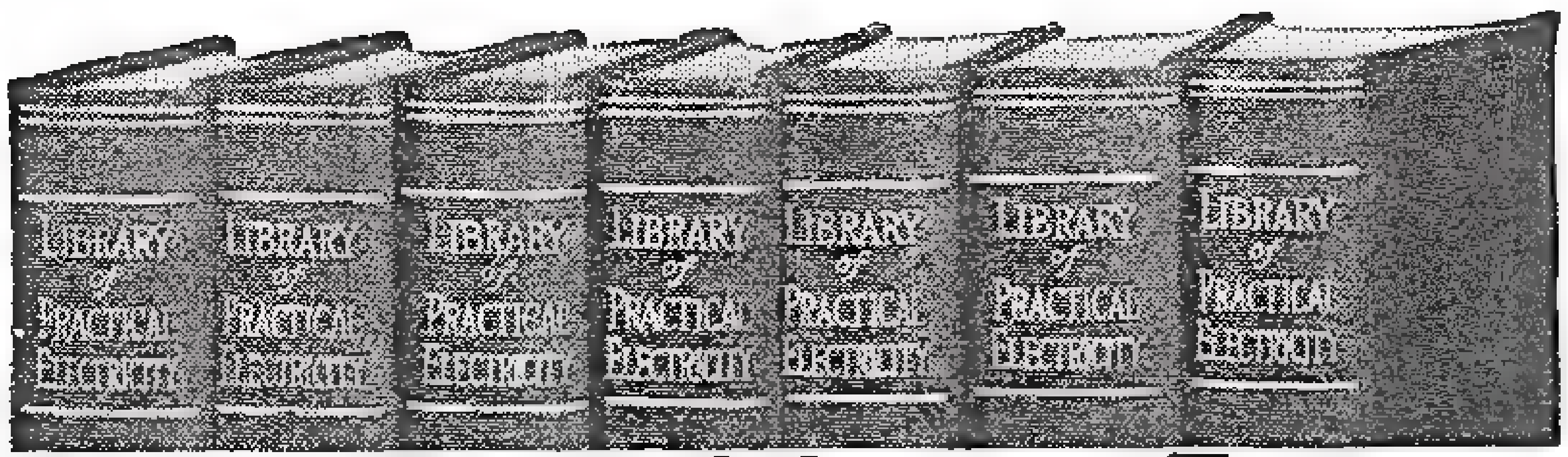

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Sun Spots' Effect On Earth-Bound Man Told In Book

DID you know that the best vintage wines are from crops that grow in those years when sunspots are at a maximum? And that trees show their greatest growth in periods when the surface of the sun shows the greatest number of spots? Or that the Dow-Jones stock market averages follow a curve which is very similar to curves based on sunspot numbers?

These are only a few of the many remarkable, but unexplained, coincidences between the activities of plant and animal life on earth and the appearance of those gigantic electro-magnetic disturbances on the sun which man calls sunspots.

More and more scientists, and others, are probing sunspots and seeking to learn the relationship between their appearance and the multitudinous activities of earth-bound man. In his newest book, "Sunspots and Their Effects from the Human Point of View," Dr. Harlan True Stetson, astronomer and research associate of the Massachusetts Institute of Technology, summarizes the knowledge which science now has in its possession to analyze for the truth or falseness of speculation on this intriguing matter.

Dr. Stetson goes out on no limb to forecast, in so many words, a definite relationship. Rather he piles up, item by item, an imposing array of facts which offer a true challenge to those who are skeptical of the sunspot's bearing on terrestrial activity.

Psychologist Uses Radio To Check "Hams' " Personalities

CAN you judge a man's personality from hearing his voice over the radio? The possibility is being tested by a psychologist who is also a "ham" with his own radio transmitter in his study, Dr. E. Lowell Kelly, of Connecticut State College.

Fifty other amateur radio fans will take part in the experiment. Each of them will be rated on 36 different personality traits by personal acquaintances and also by those who know him only by radio. Comparison of the two ratings will reveal to what extent a man's personality "gets across" through the medium of the microphone.

Intelligence, sociability, popularity, initiative, courtesy, cooperativeness, culture, honesty and disposition; these are among the traits to be evaluated on Dr. Kelly's 36-point scale. If the experiment demonstrates that radio does reveal the personality, another experiment will be undertaken with those amateurs who use only code. This will eliminate the voice as a means for revealing the personality and confine the test to the individual's "style" of broadcasting, his conversational habits and selection of words.

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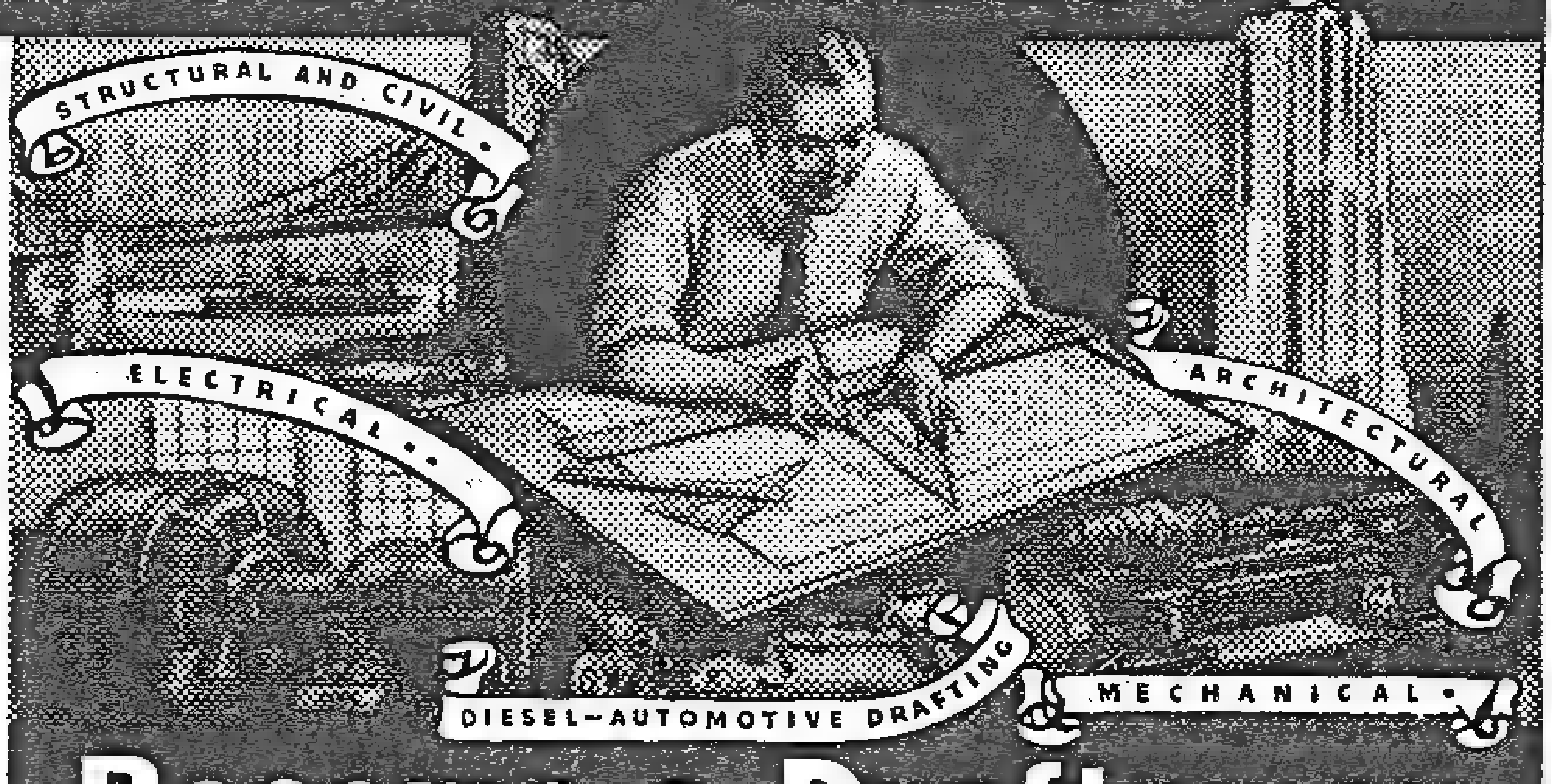

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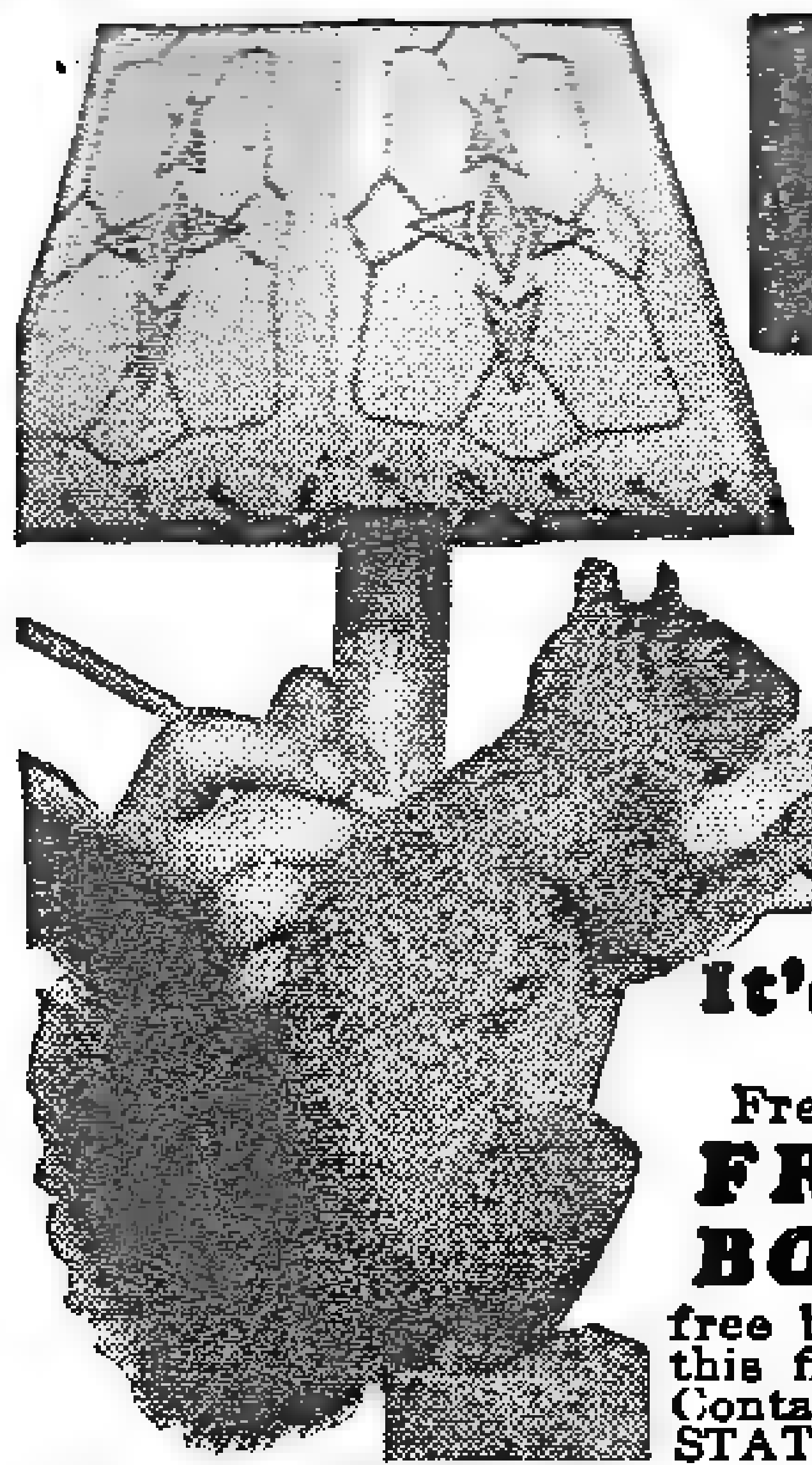

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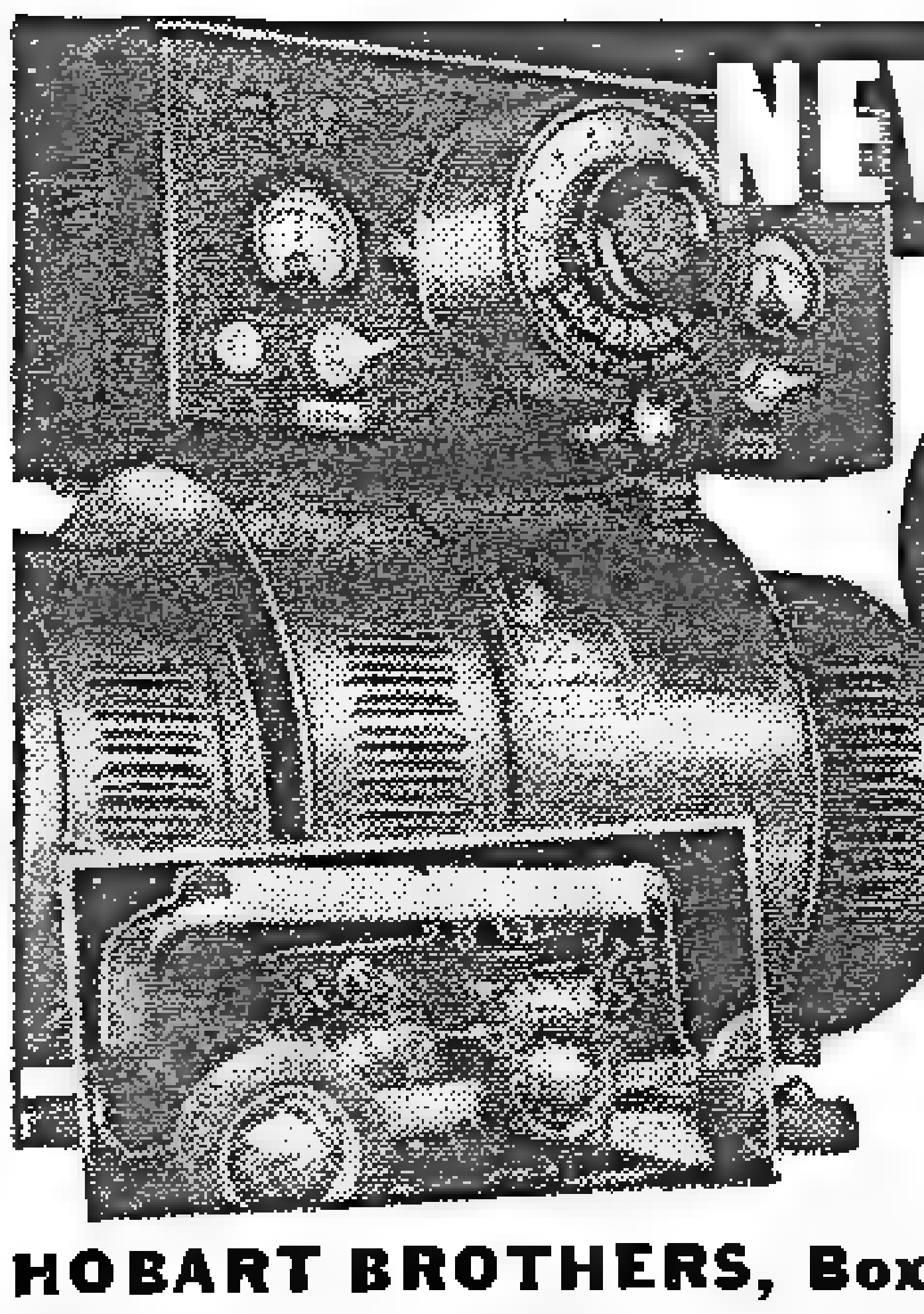

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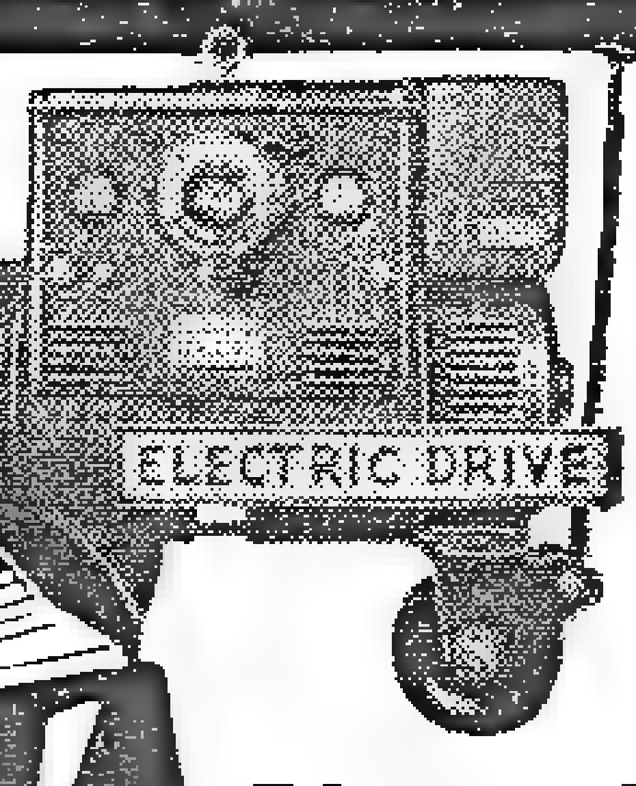

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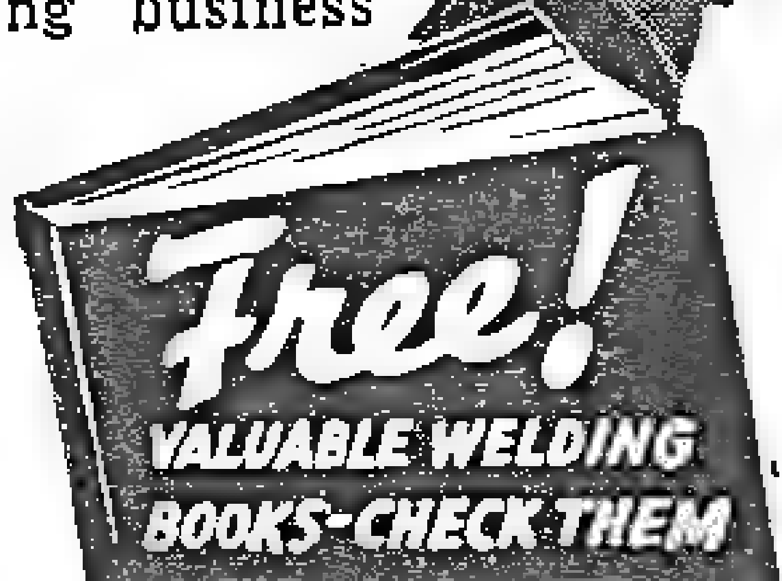

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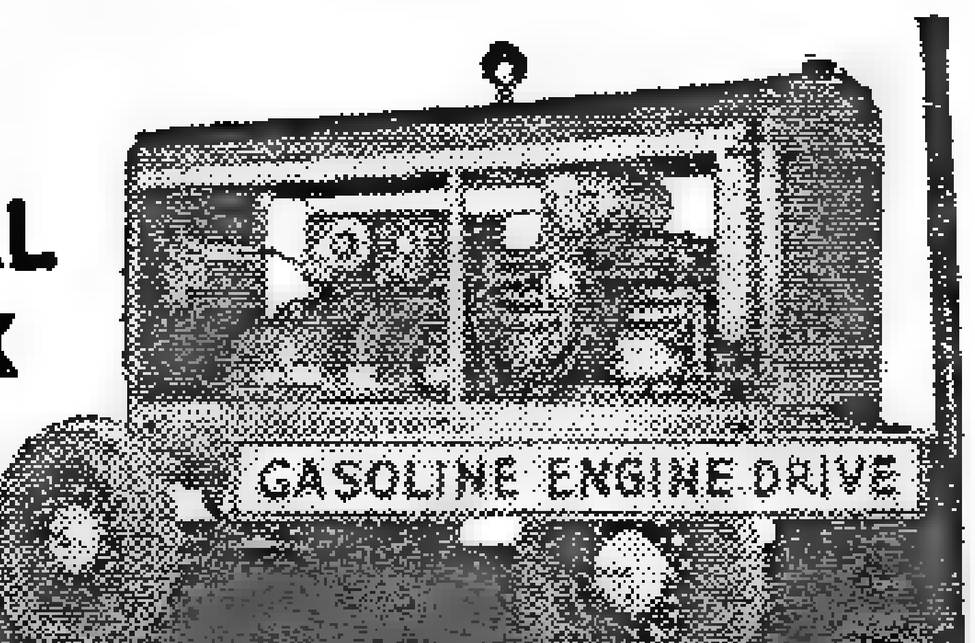

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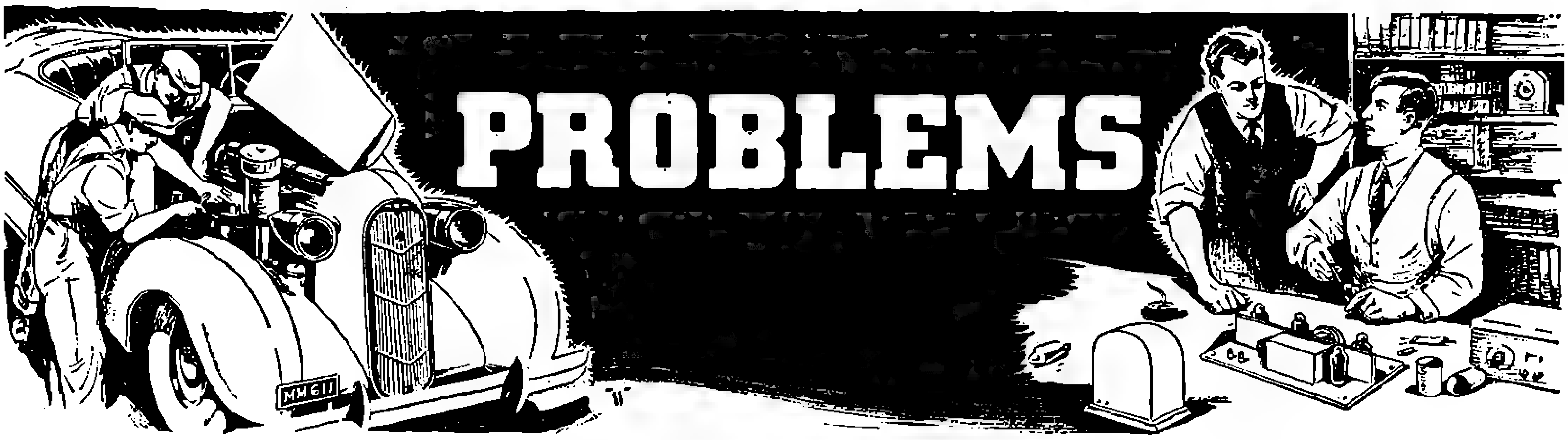


Editor's Note: Your questions will be answered personally and free of charge by MM experts provided they do not require special research or involve trade secrets. Names and addresses of manufacturers of new products described in this issue can also be obtained free upon request. Enclose a self-addressed and stamped envelope for reply. Address: Problems Editor, Modern Mechanix, 1501 Broadway, New York City.

WHAT IS HORSEPOWER?

What is horsepower? Does it mean that an engine of one horsepower can do the work of one horse? It probably means something else but I am not sure.—Herbert Brennan, Pendleton, Ore.

Horsepower today has no connection with the amount of work a horse can do. In this country, one horsepower equals 33,000 foot pounds of work per minute, that is, the amount of work necessary to raise 33,000 pounds one foot in one minute. This standard may be applied to any combination of these values as long as the proportion remains the same. In other words, 66,000 pounds raised one foot in two minutes equals one horsepower. Also, 550 pounds raised one foot in one second equals one horsepower. In the eighteenth century, the amount of work which could be done in one minute by an average draught horse was considered one horsepower. The French standard of horsepower is 32,549 ft. lbs. of work in one minute.

WHEEL BASE AND TREAD

What is the difference between the wheel base and tread of a car? I notice in advertisements of cars that wheel base is mentioned but I never notice anything said about the tread.—Robert Harrison, Chicago, Ill.

Wheel base is the distance in inches between the front and rear axles. This distance is measured from the exact center of each axle. Tread is the distance between the front wheels, or the rear wheels. This is measured from the exact center of each wheel. The standard tread is 56 inches. Although the tread (also called the track) seldom varies, wheel base changes with car design.

OHM'S LAW

I have heard of Ohm's Law many times but I don't know what it is. Can you explain it to me?—J. L. Anderson, Miami, Fla.

The unit of resistance is the ohm. This is defined as the amount of resistance through which one ampere of current will pass when under one volt pressure. All calculations involving currents make use of this fundamental relationship. Given any two values, the third can be determined by using the formula $E = IR$, when E is volts; I, current in amperes, and R, resistance.

DETERMINING BIAS VOLTAGE

What is the formula for determining the bias for a tube used in a Class C amplifier?—R. J. Chavarie, Tulsa, Okla.

Divide the plate voltage by the amplification factor of the tube. If cathode bias is used, subtract the voltage drop across the resistor from the plate voltage before attempting to determine the bias.

ADJUSTING SPARK COIL

What is the correct method of adjusting a spark coil?—H. H. Parker, Philadelphia, Pa.

The simplest method of adjusting a spark coil vibrator is by screwing down the vibrator until a musical "buzz" is heard. If more than one coil is used, try to adjust each vibrator to the same sound.

ENGINE LACKS POWER

My engine starts easily but I am unable to get much power from it. I use good gasoline and have always taken good care of the engine. What do you think is wrong?—Phillip Miller, New York, N. Y.

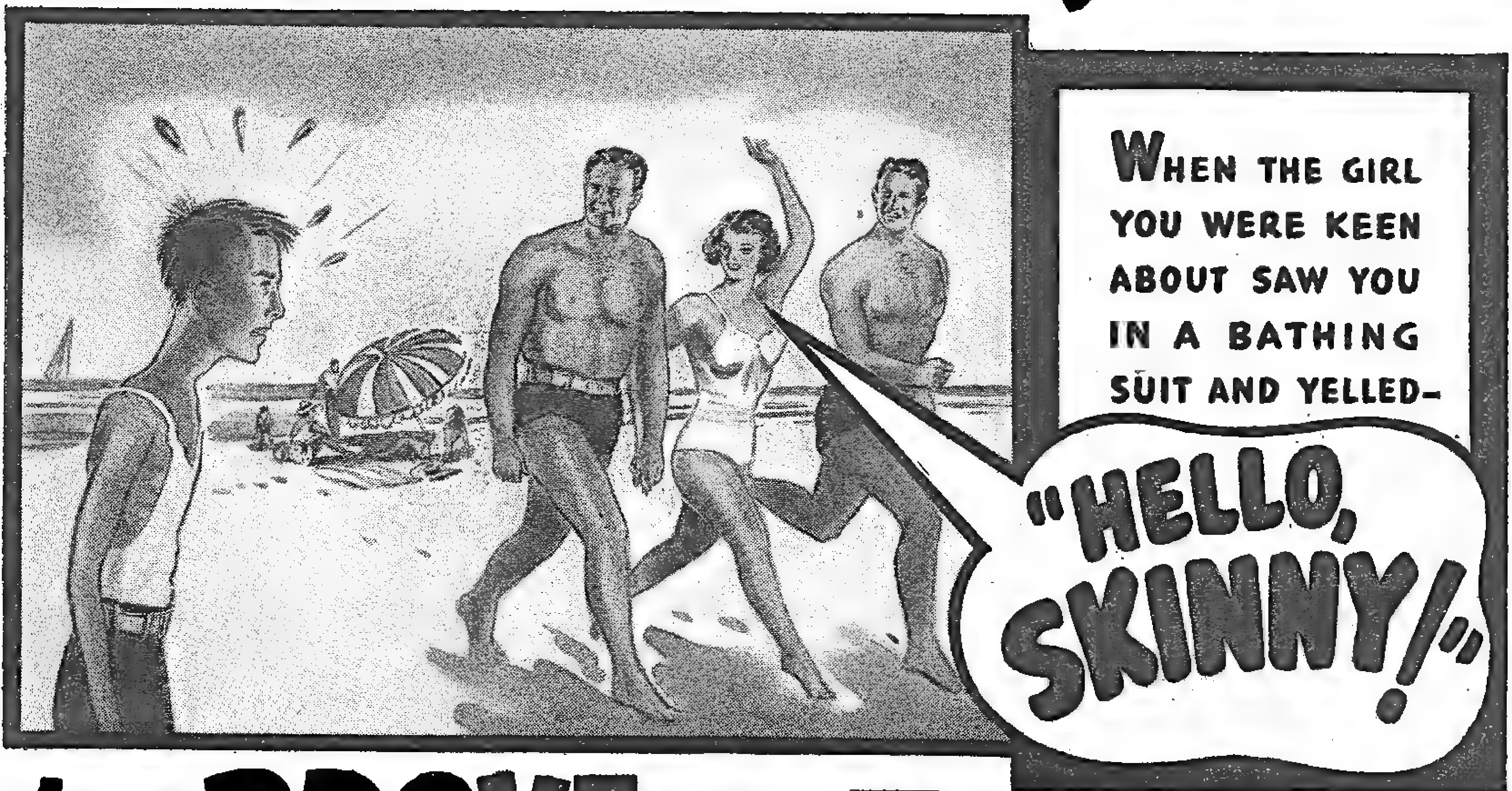
Check the carburetor for a too-rich mixture. The engine may lack compression. Also the valves may be leaking. Check the ignition for a weak spark. Be sure that the battery is charged.

FINDING CRACKS IN METAL

Is there any easy way to locate small cracks in metal, usually not visible to the naked eye? I would like to check my tools to determine if they are as strong as they should be.—Jack Roberts, Memphis, Tenn.

Moisten the surface of the tool to be checked with petroleum. Then rub it off with a dry cloth. After the surface is completely dry and clean rub it off again, but this time with some chalk placed on the cloth. If there is a crack in the metal, the petroleum that entered will come out when the chalk is rubbed over it, thereby giving evidence of the crack.

Life's Most Embarrassing Moment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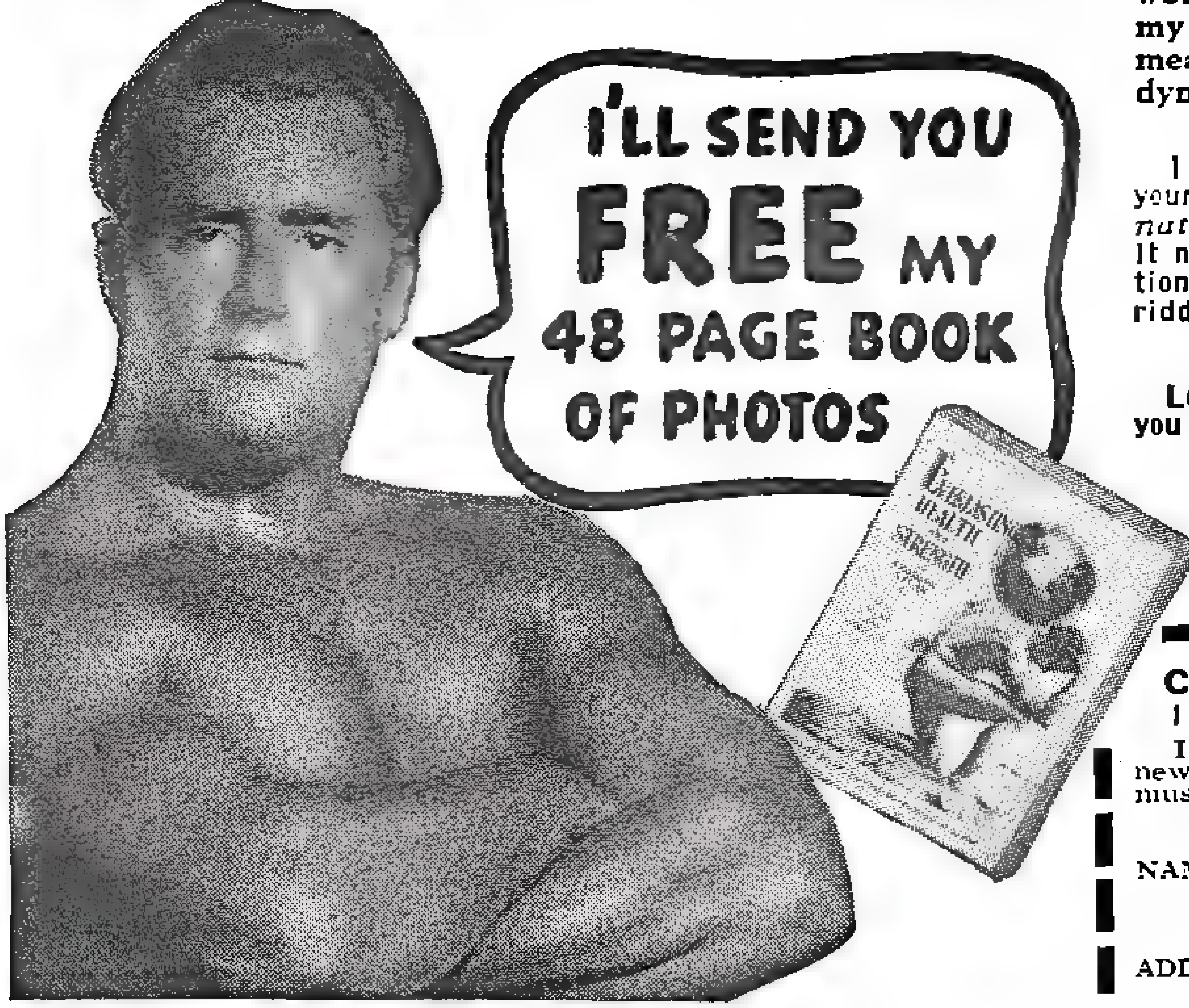
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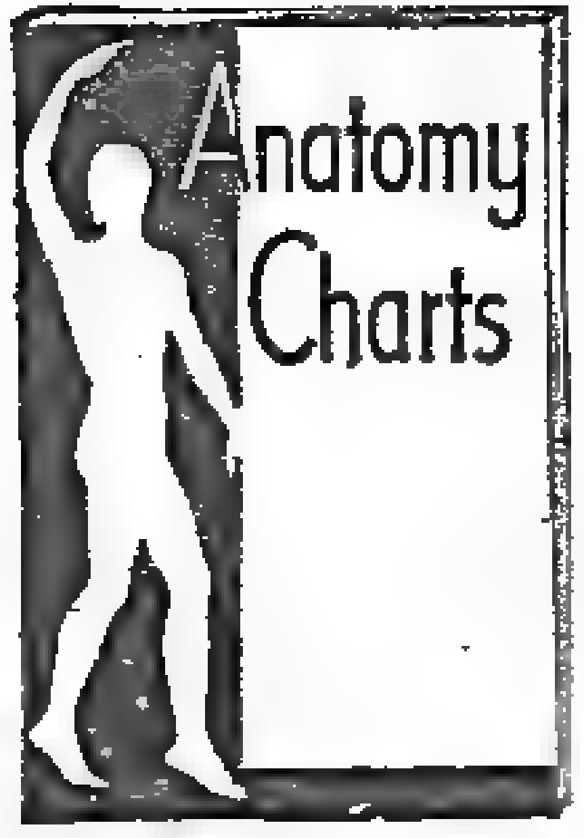

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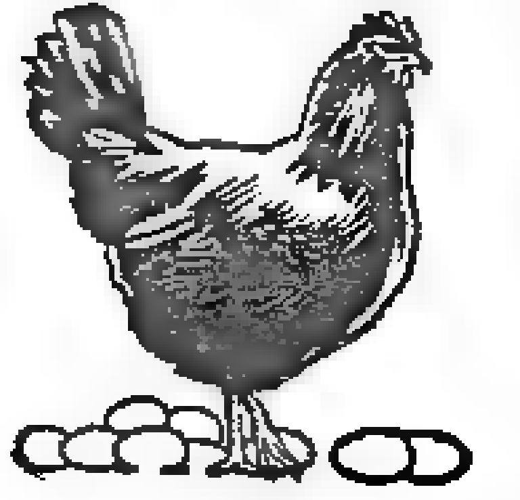

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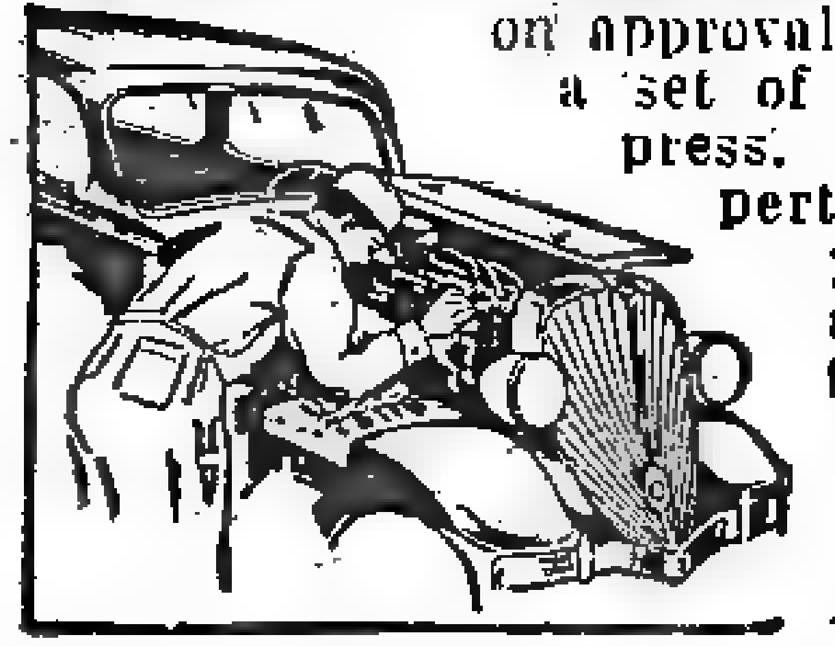

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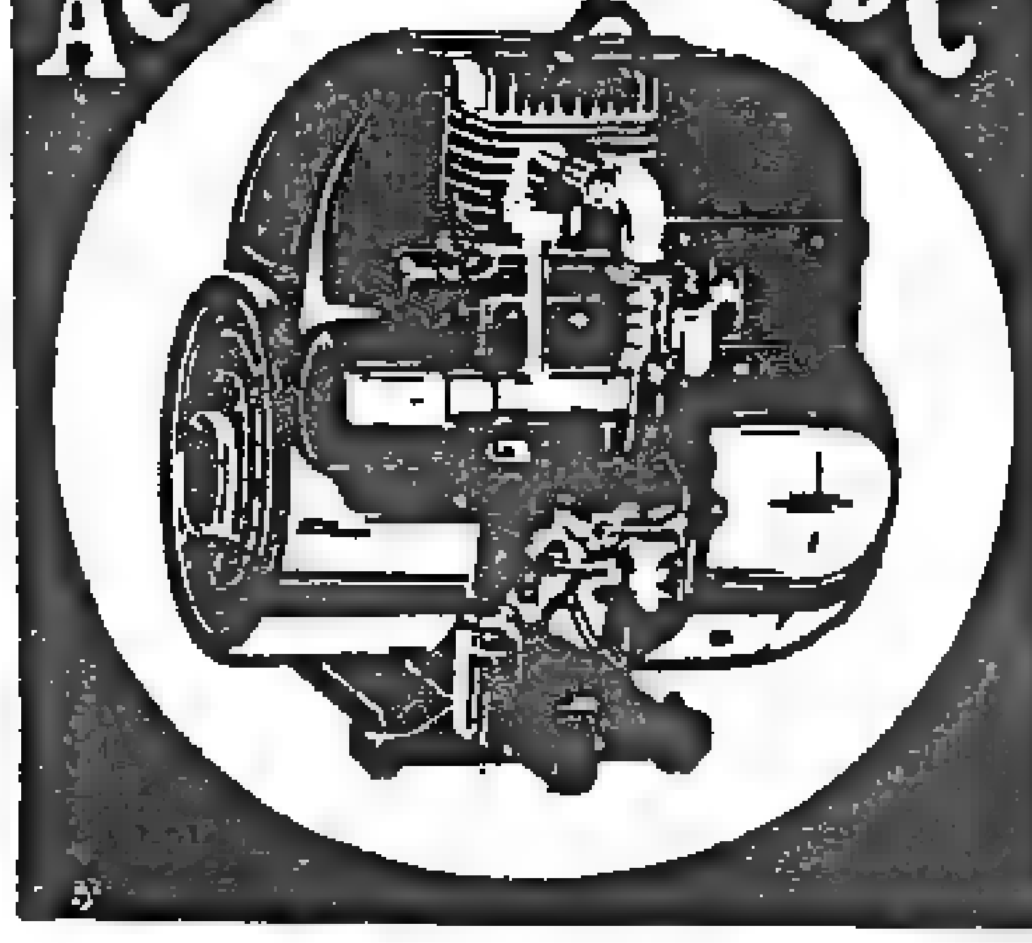

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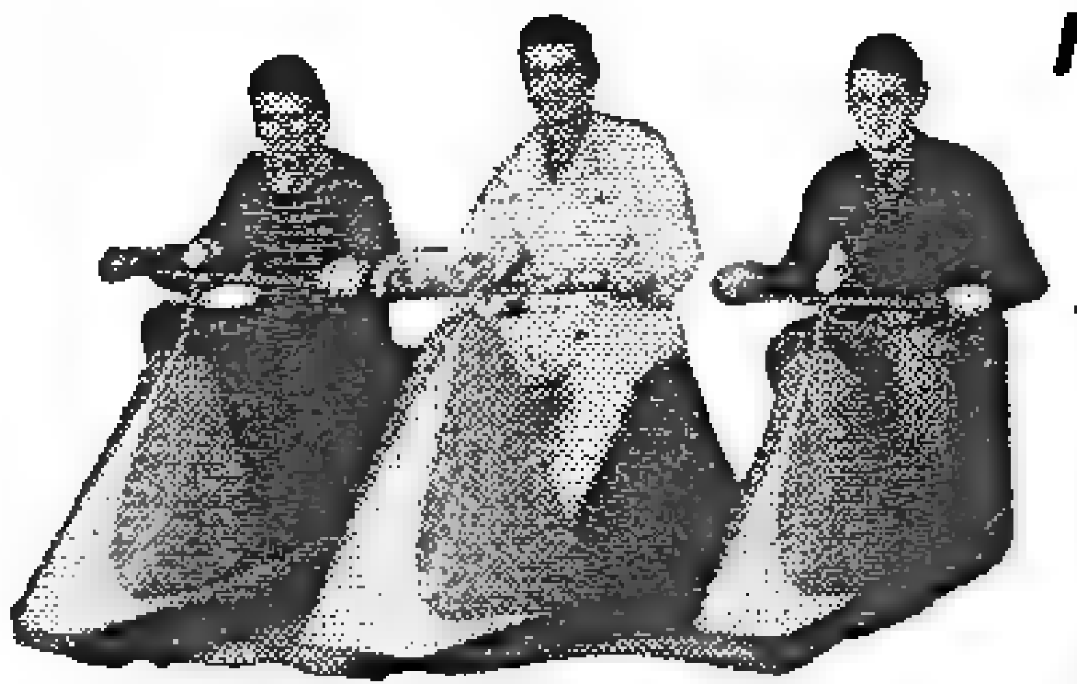

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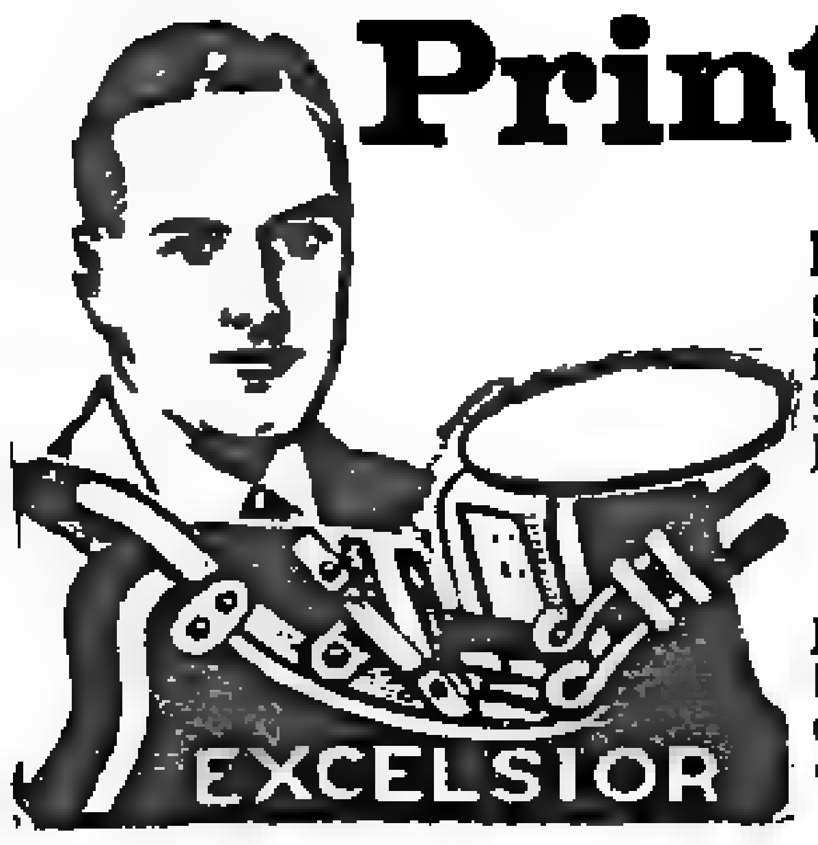

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The method has proved so successful in "finding accidents before they happen" that the Bureau of Aeronautics urged its use on all vital parts of airplanes and engines. Ford engineers believe they are the first to bring this safety measure into the automobile field.

The apparatus is simple to operate. It consists of a powerful coil of new design, which quickly magnetizes the part to be tested. The operator then dusts the part with iron powder. The powder piles up in plain view along the entire length of any flaw in the metal.

"A crack too small to be detected otherwise still is large enough to split the magnetic field," one of the automotive technicians said. "The field is positive on one side of the flaw and negative on the other. The iron dust therefore, is drawn at once to the flaw and makes it plainly visible."

A feature of the new flaw finder is its adaptability to mass production technique. Parts sent through the magnetizer are placed in an oil bath containing iron powder. Any crack is disclosed instantly to the inspectors since the oil makes the line of powder, which collects along the flaw, visible at a glance.

Army Orders "Flivverplane"

While titles in military forces of the smaller Central and South American countries have been the subject of much humor, Nicaragua recently went on record as one of the most progressive countries of the world in one respect. A Cub "flivverplane" (40 H.P.) recently purchased and shipped to the Nicaraguan Army at Corinto. Nicaragua, will be used for primary training of military pilots there.

It has long been recognized by experienced instructors that a substantial part of an airplane pilot's training may be given in low powered economical airplanes, such as the Cub, with a tremendous saving in cost. There are also many benefits to the embryo pilots training in safe, easy to fly planes, leading to greater proficiency and self-confidence. Results of the Nicaraguan experiment, therefore, will be carefully noted by aeronautical experts.

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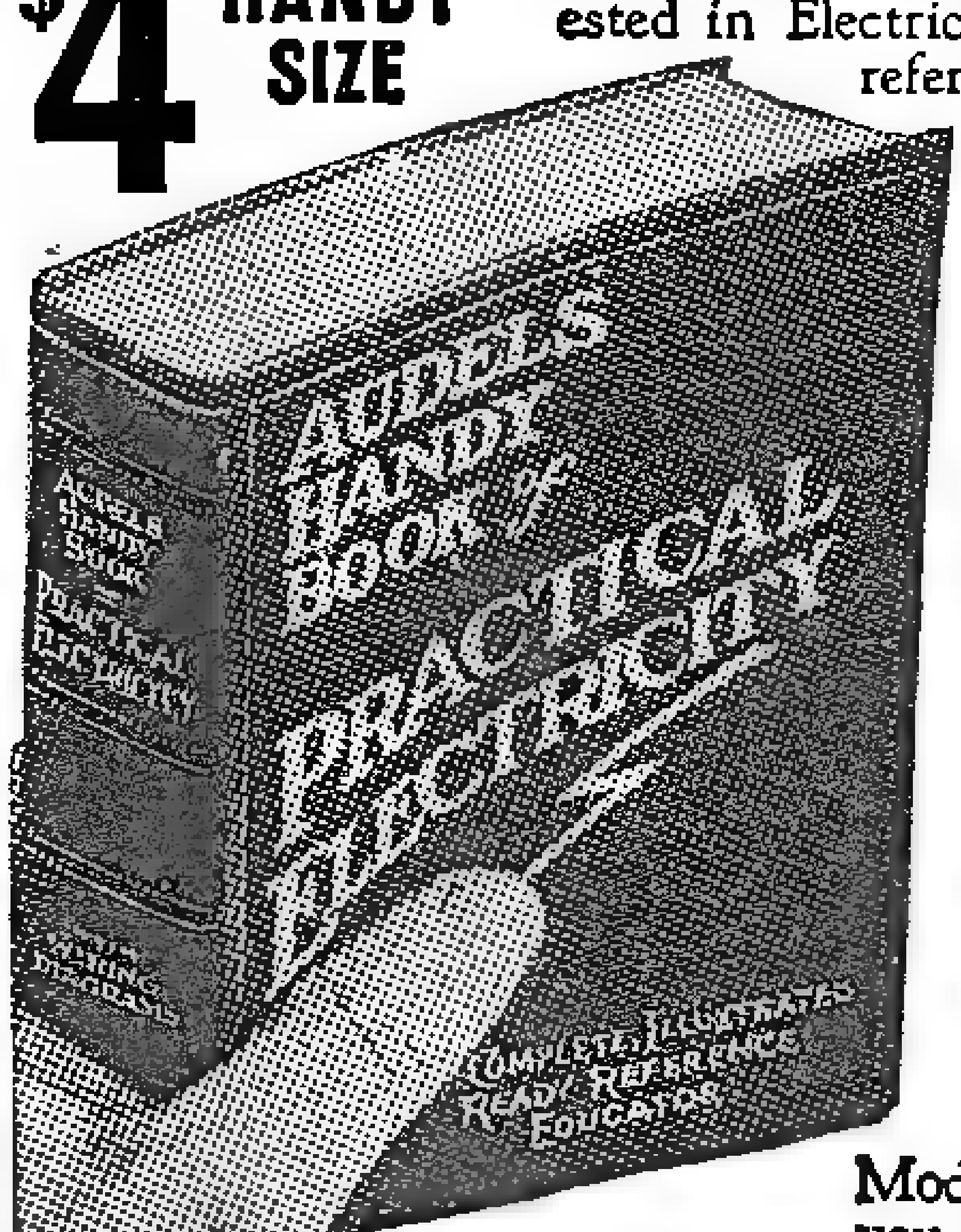
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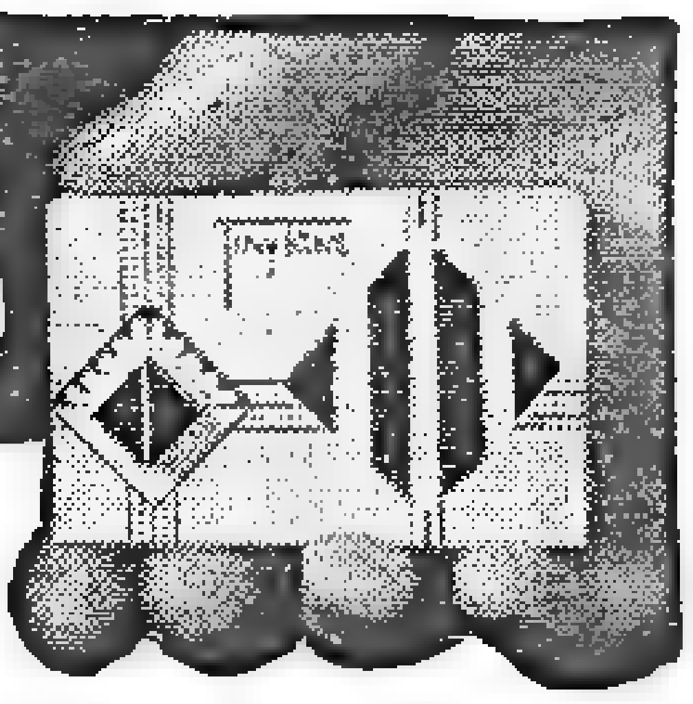

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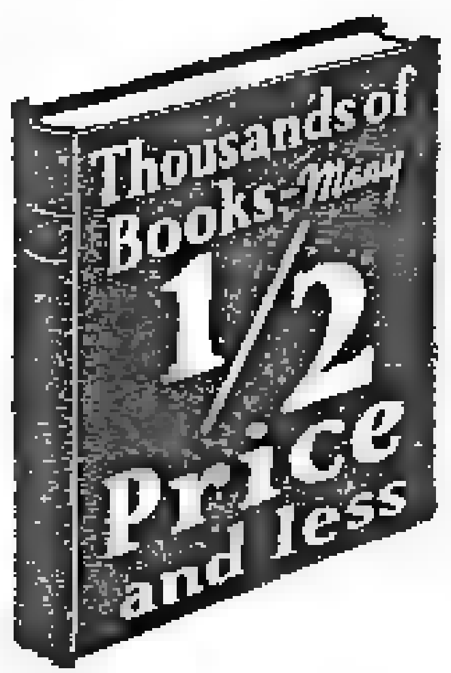

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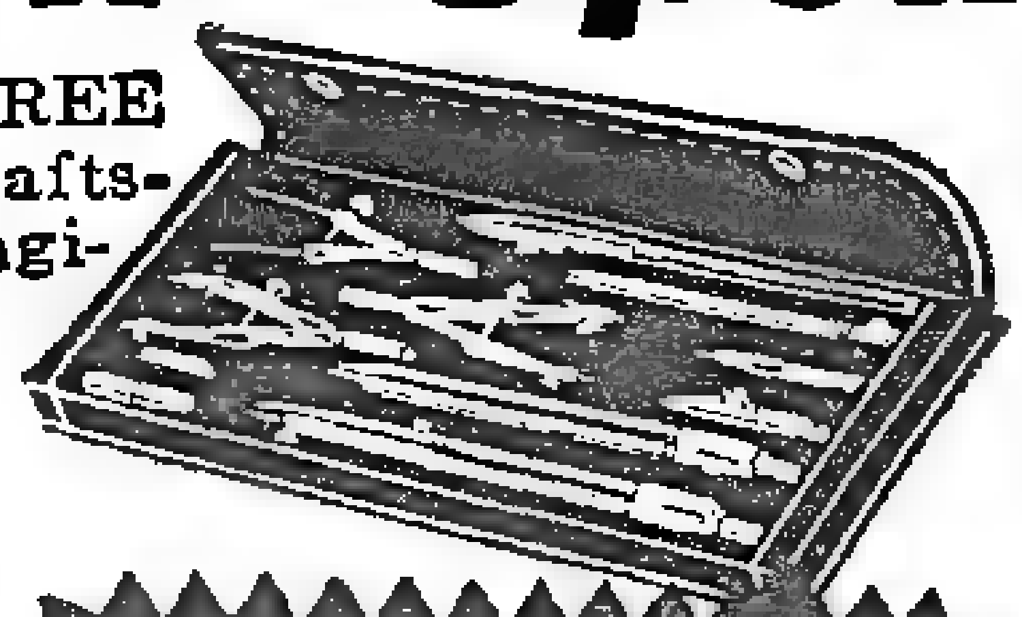

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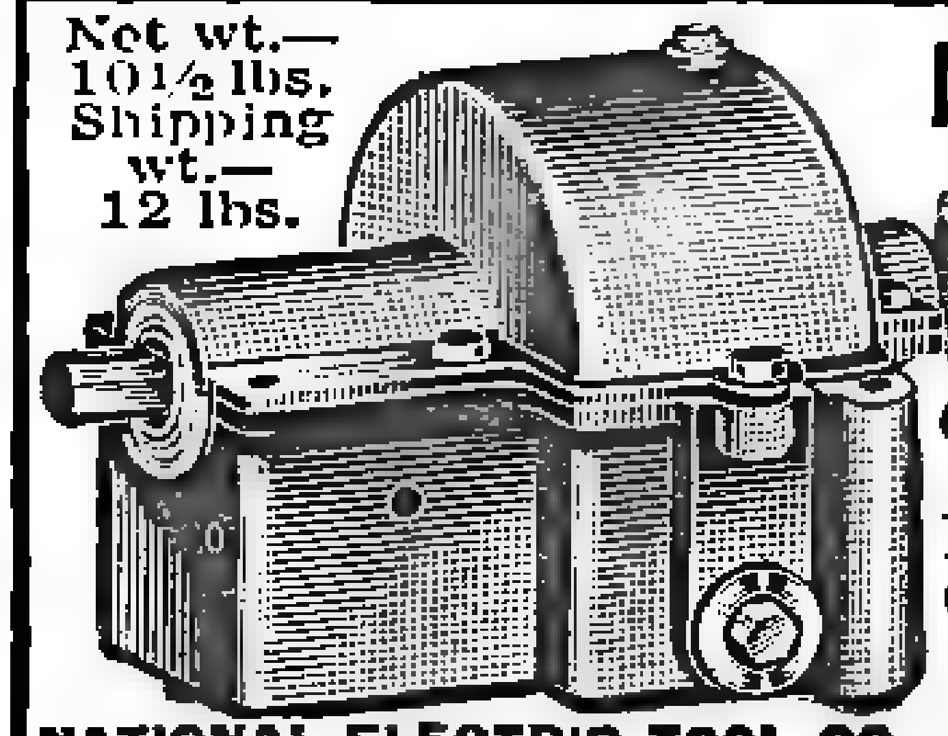

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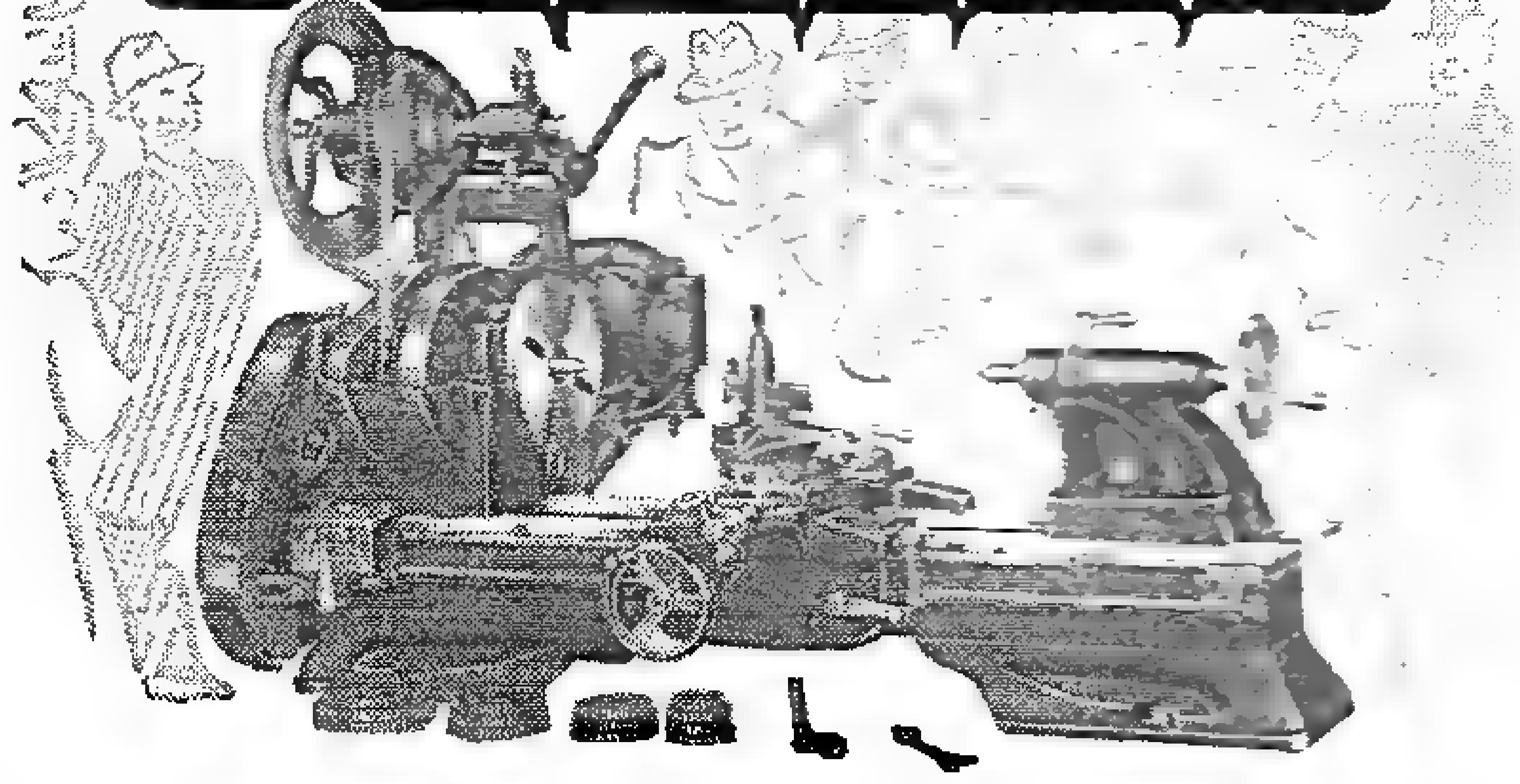

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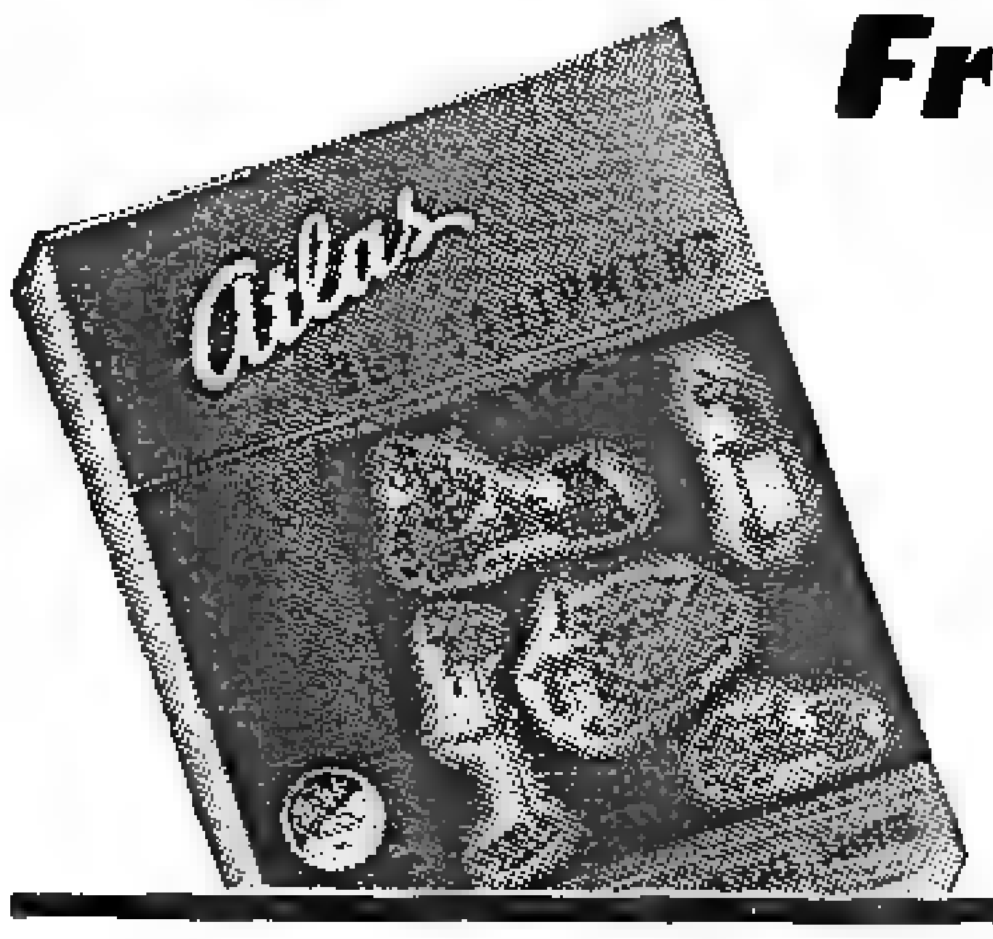

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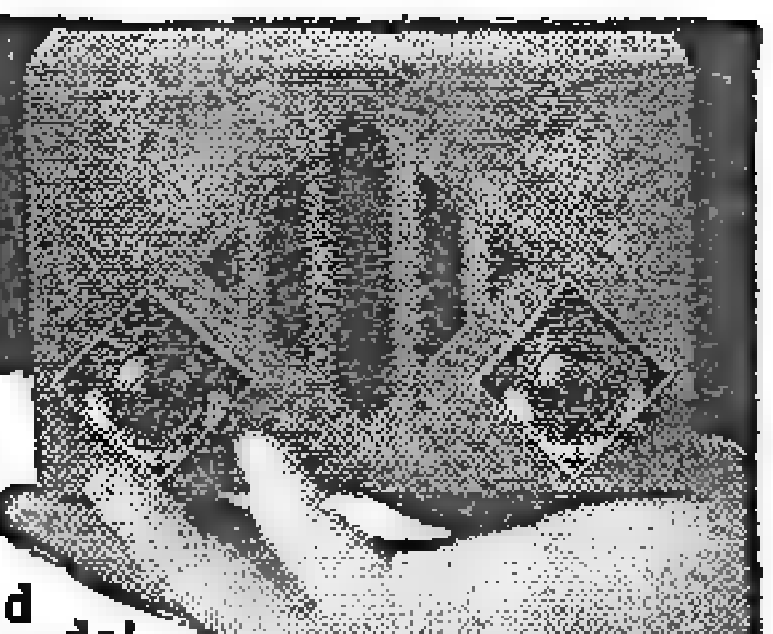

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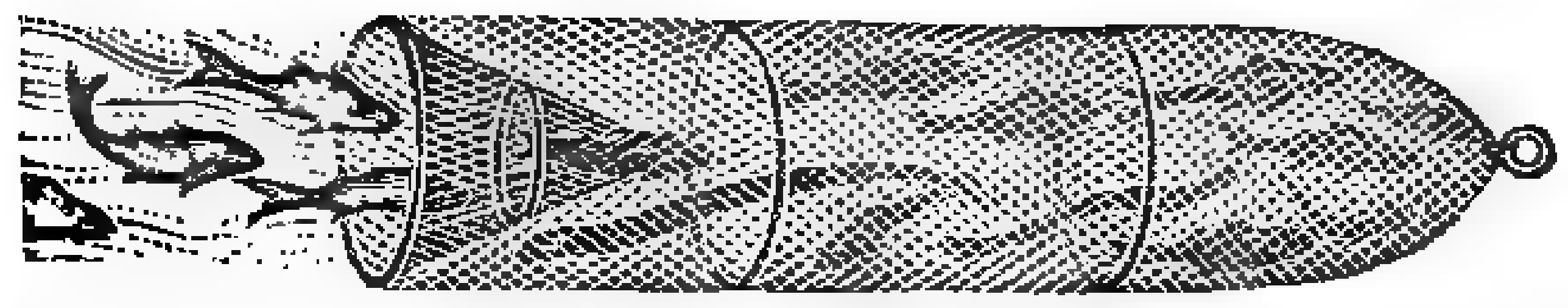

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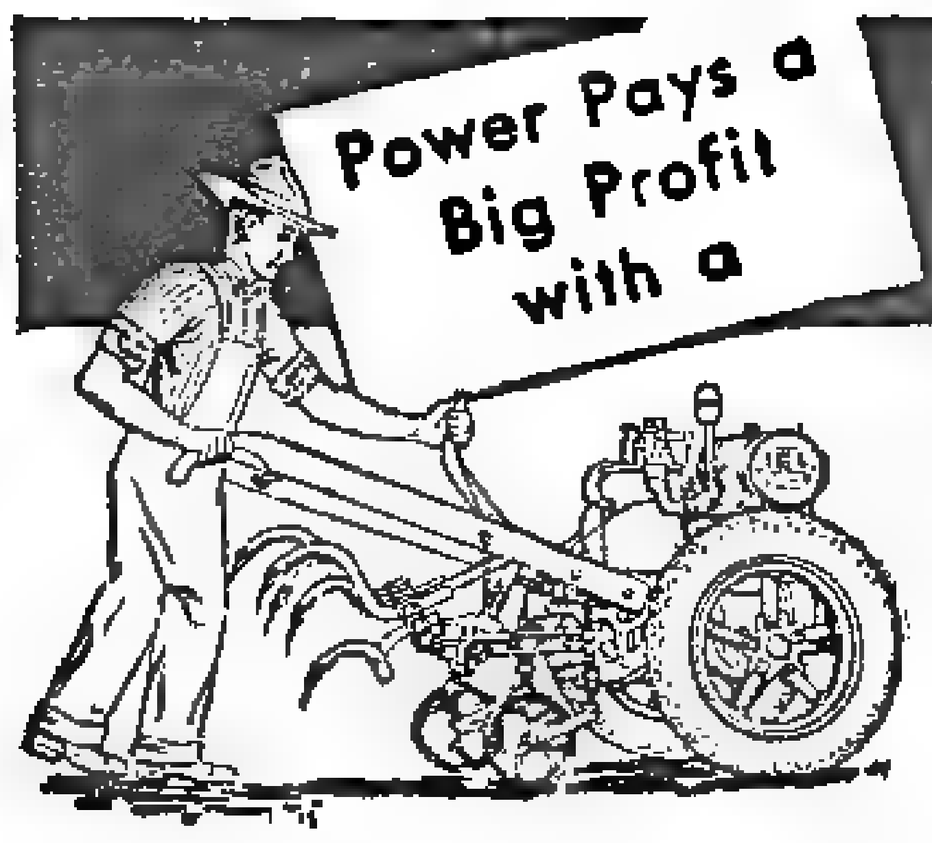
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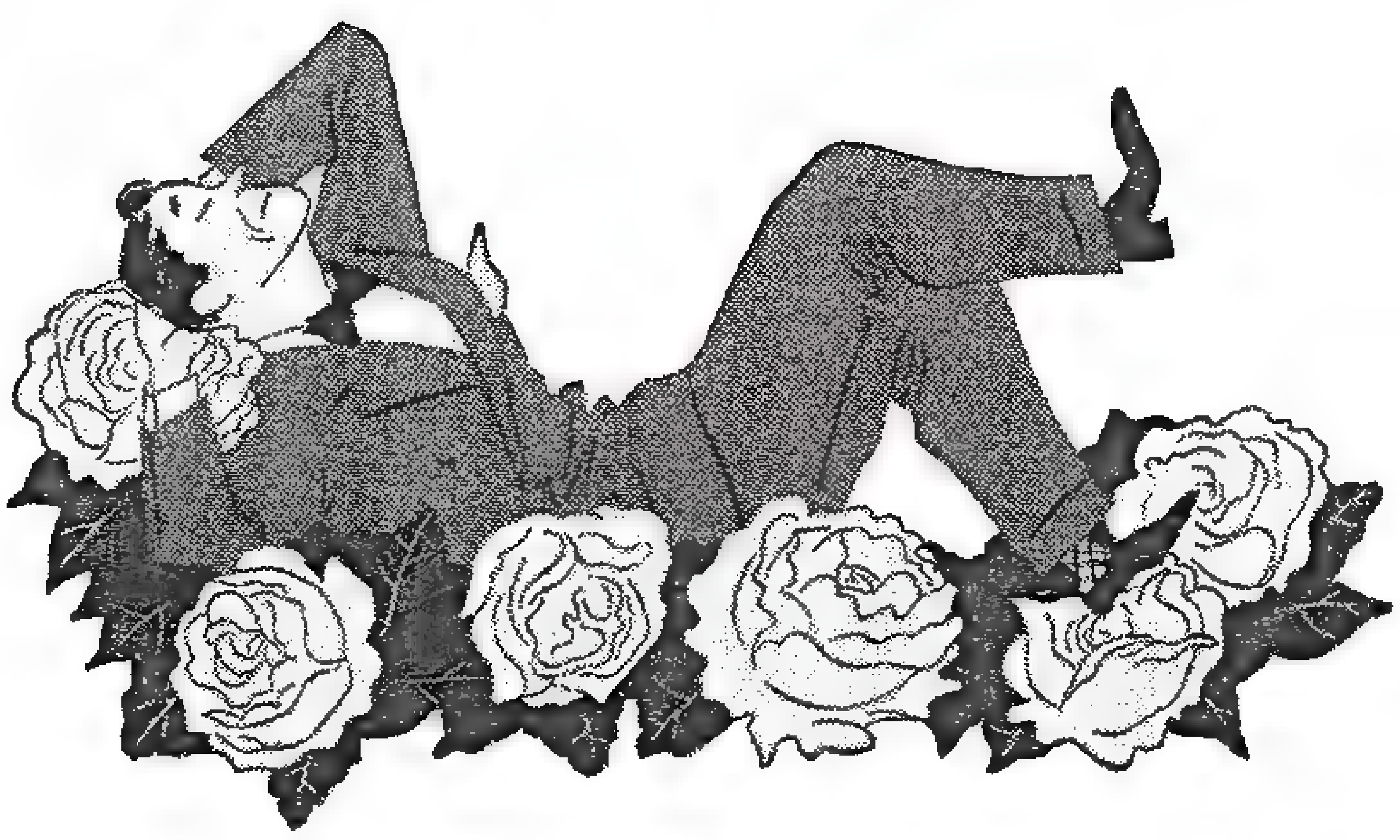

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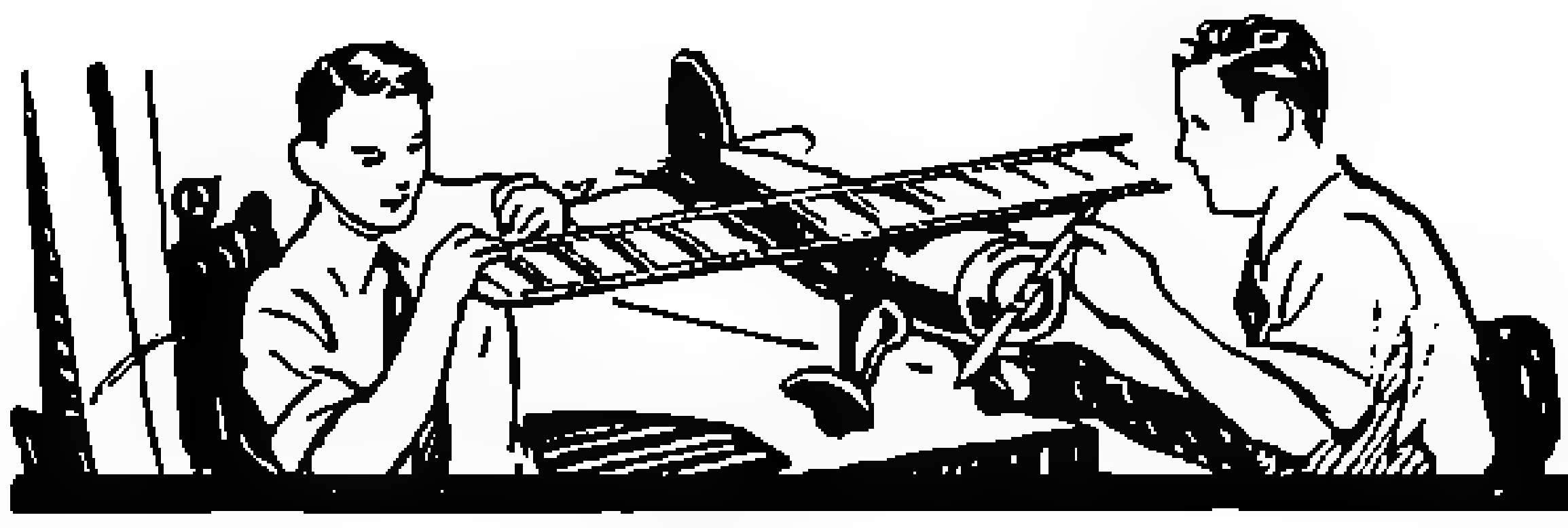
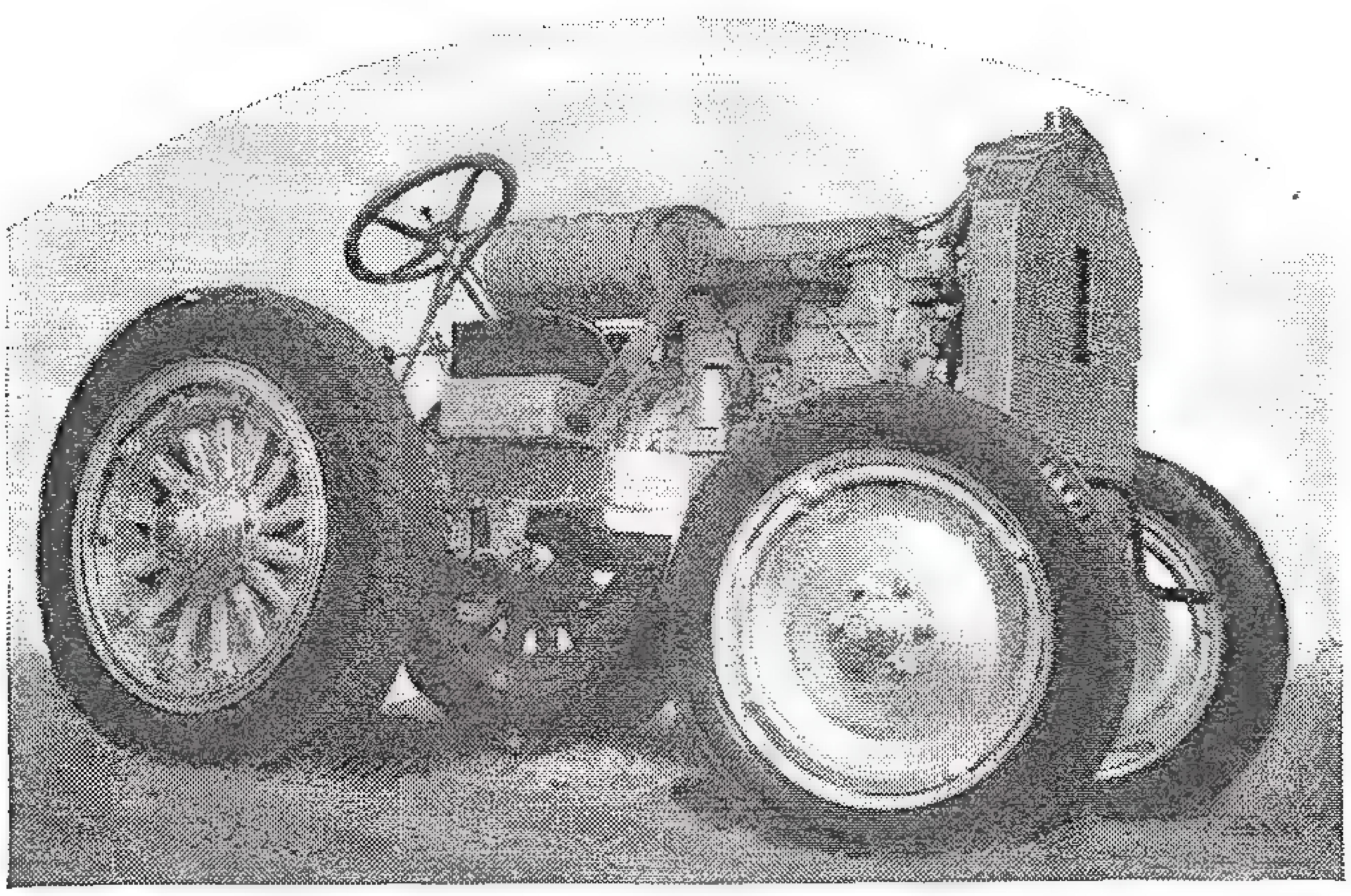


Chips from the



Built entirely from salvaged parts of old automobiles by 78-year-old M. O. Stetler, of Kingfisher, Okla., this garden tractor features six forward speeds and a one-wheel brake.

AWARDED first prize of $5 in this month's Workbench contest, a letter received from Bob Stetler, of Kingfisher, Okla., will undoubtedly interest many of our rural readers. The letter says:

> Dear Editor:
>
> Enclosed is a photo of a home-built garden tractor made by 78-year-old M. O. Stetler.
>
> The parts were all taken from discarded autos and trucks, the engine, frame and transmission being salvaged from a 1928 auto. The front axle was taken from a popular car, but was shortened and inverted to give greater clearance. The rear axle is from an old truck.
>
> The engine incorporates a centrifugal-type governor, driven by a fan belt and controlled by a choke assembly running through the steering column. Braking is accomplished by means of a lever and shoe attached to the right rear wheel.
>
> Bob Stetler

We don't know what relation Bob is to M. O. Stetler, builder of the tractor, but we certainly don't blame him for being proud of his relative's craftsmanship.

***

Midget racer fans will be interested in a letter received from Charles and Francis Dusch, of Ashland, Pa., which was awarded a prize of $3. The letter reads:

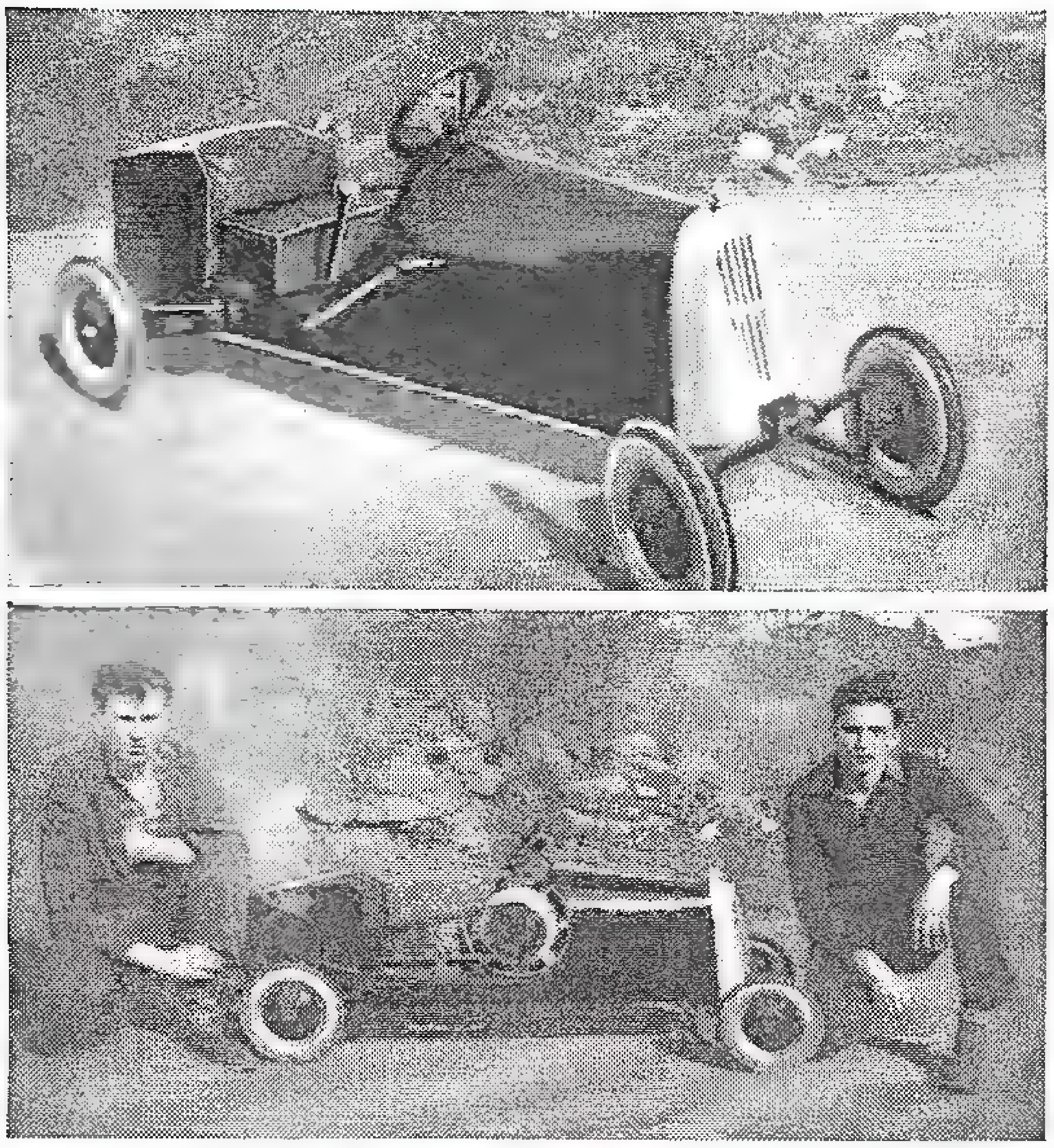
> Dear Editor:
>
> We are sending you two pictures of our midget racer. It was built from plans that appeared in MM quite some time ago.
>
> The car weighs 136 pounds and has a four-foot wheel base. It attains a speed of about ten miles per hour, powered with a ¾-horsepower washing machine engine. Due to the size of the car, we were forced to change the position of the engine, which is connected to the rear wheels by a combination belt and chain arrangement, as shown in the photos.
>
> We will gladly answer questions from MM readers if they enclose a stamped return envelope with their letters.
>
> Charles and Francis Dusch.

Here is a chance for you midget racer "bugs" to correspond with two brothers who undoubtedly are good craftsmen.

***

A letter from Howard Allen, of Hammond, N. Y., describing his home-built outboard motor boat was also awarded a $3 prize. He says:

> Dear Editor:
>
> I am enclosing a photo of "Buzzer", built from plans in the MM book—"How To Build 20 Boats". I built the boat a little heavier than called for in the book, but it goes 27 m.p.h. with a 22 horsepower outboard motor.
>
> The boat handles very nicely and I have been out during some of the strong winds that sweep the St. Lawrence River, shipping very little water. Several people have admired the boat and said they were going to send for the plans. Please print more boat plans in the future.
>
> Howard Allen.



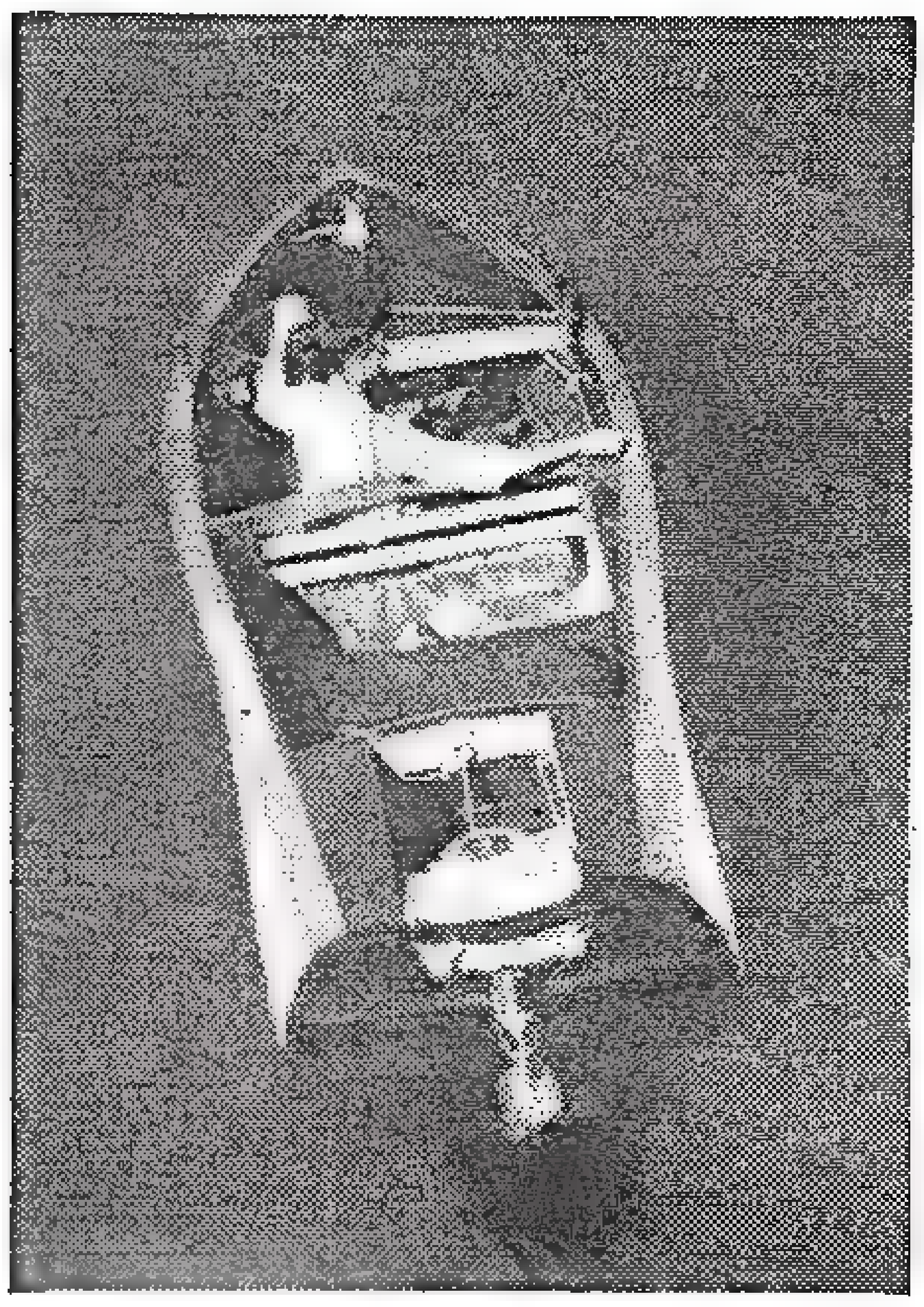
Charles and Francis Dusch proudly pose with the midget racer they constructed from MM plans. The close-up shows details of the tiny car which is powered with a ¾-horsepower engine.

Editor's Workbench

Boat fans will readily admit that Allen's "Buzzer" has trim lines and the strong winds and rough water evidently proved its sea-worthiness. How about it, fans? Why not get a copy of the MM boat book (price 50c) and build a "Buzzer," too. Make summer time boating time.

***

Model plane enthusiasts are usually prolific builders of solid and flying models, but how many can equal Marshall Anderson, of North Warren, Pa., who, in his letter which was awarded a $3 prize, states that he has built 35 models? He writes:



An unusual overhead view of "Buzzer," built by Howard Allen.

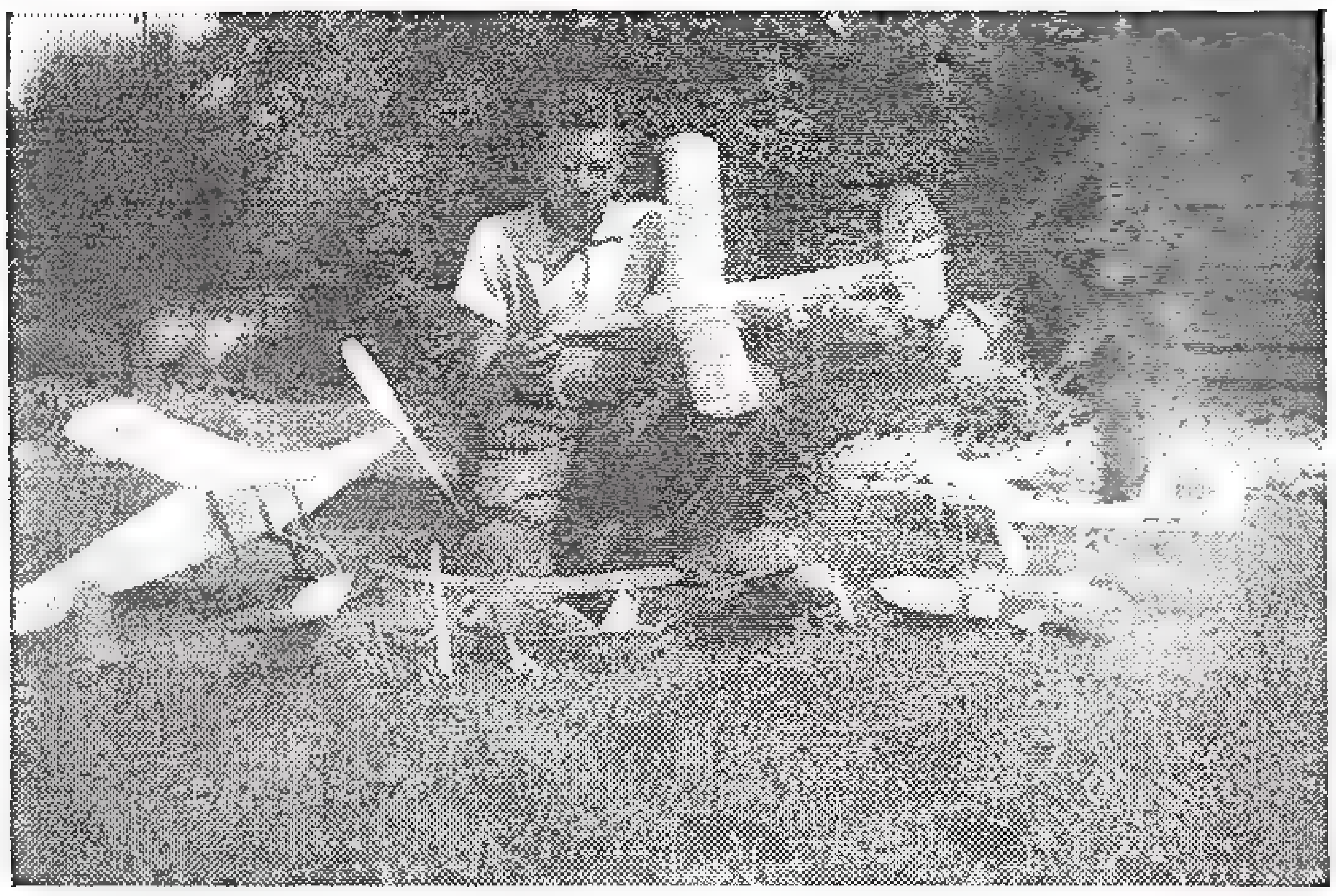
Dear Editor:

I am sending you a photo showing a few of the 35 airplane models I have constructed. I would like to see plans for a compressed air model in MM.

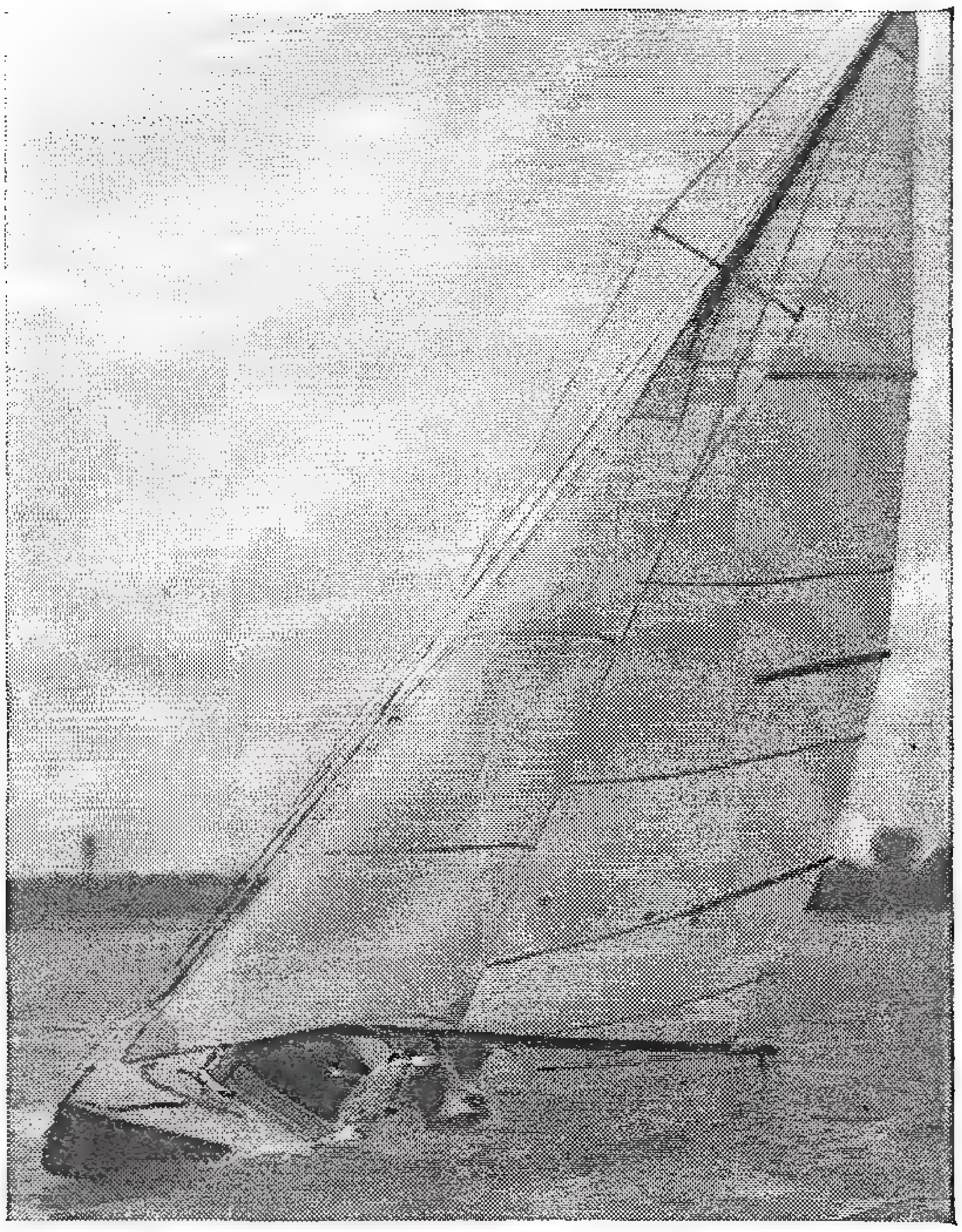
I am 16 years of age and would like to hear from fellows who are interested in model plane building. Please mention this if you print my letter.

Marshall Anderson

Good work, Marshall. Building 35 airplane models is quite an achievement. We are sure that other MM model plane fans will be glad to correspond with you.



Marshall Anderson, a prolific MM model plane builder, is shown here with a few of the 35 flying models he constructed.



This splendid action "shot" was sent in by Tom Griberg. It shows the MM "Sunray" sailboat he built at a cost of $84.01.

Tom Griberg, of Moline, Ill., sent in a letter which was awarded a $3 prize. The letter reads:

Dear Editor:

Most of the pictures you print of sailboats built by MM readers show the boats either moored or sailing "flat." I am enclosing a real action photo of "Sunray", an MM boat. We have found that even with a 170-pound man sitting on the low side and the water running along the top of the cockpit coaming, the boat is still stable.

My "Sunray" was built in five weeks of spare time at a total cost, including sails made from airplane fabric, of $84.01. For the second season of sailing, I replaced the centerboard with a metal fin.

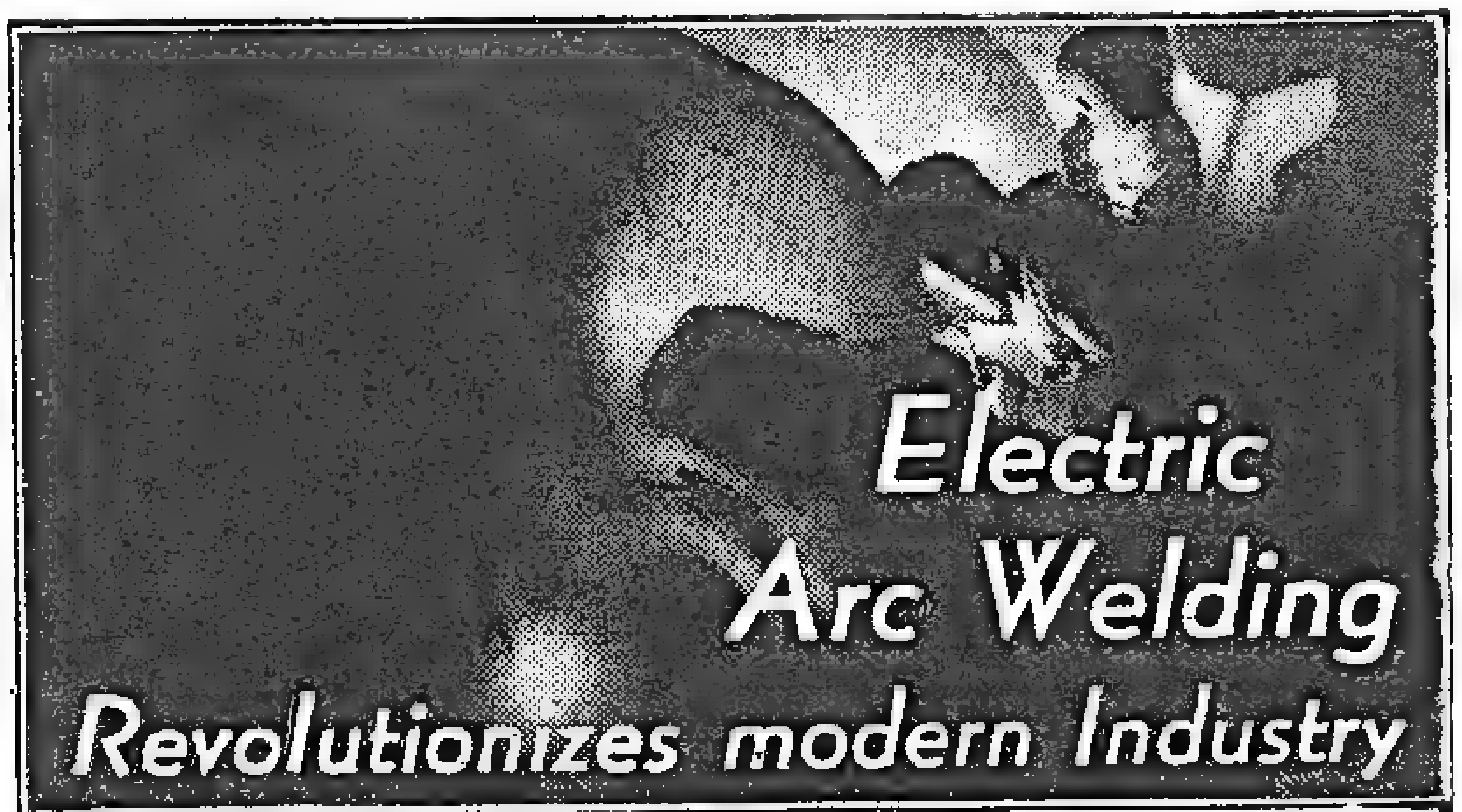
Tom Griberg.

We try to get action photos of all boats built by MM readers, Griberg, but most of the photos submitted show the boats moored, as you say. Remember this point when sending in photos of your boats, readers.

***

An interesting letter received from Charles Fottler, of Dorchester, Mass., was also awarded a $3 prize. His letter reads:

[*Continued on page* 31]



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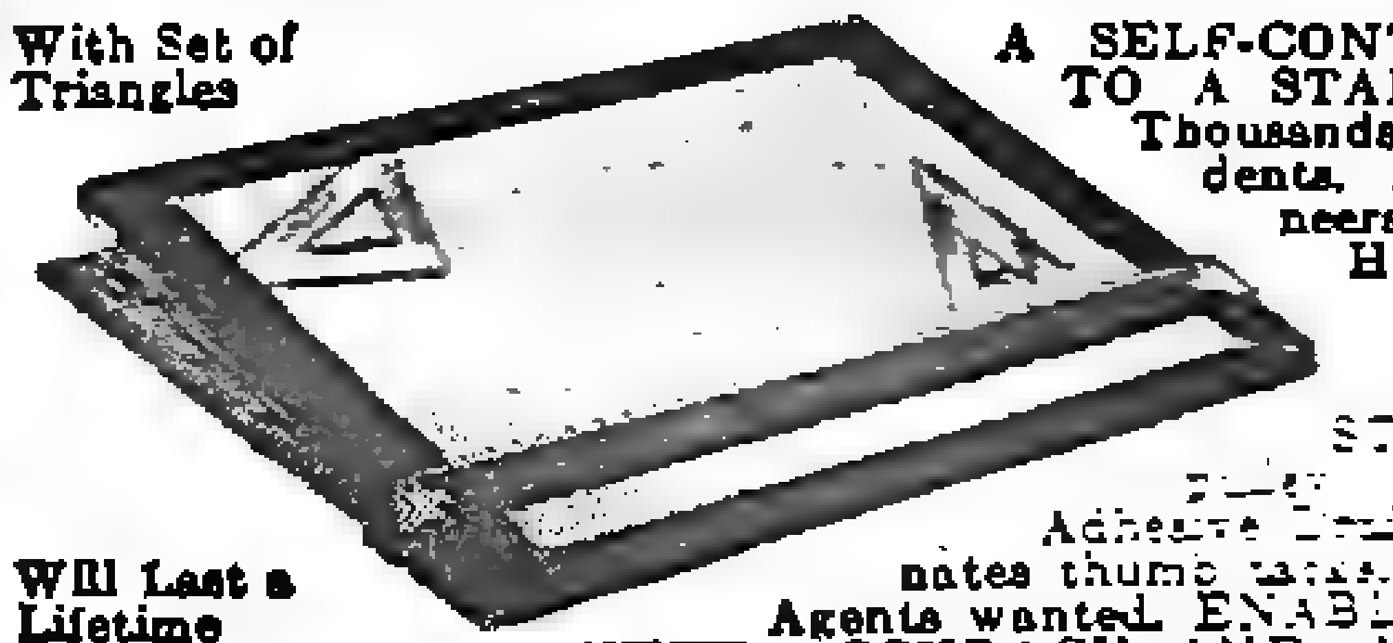

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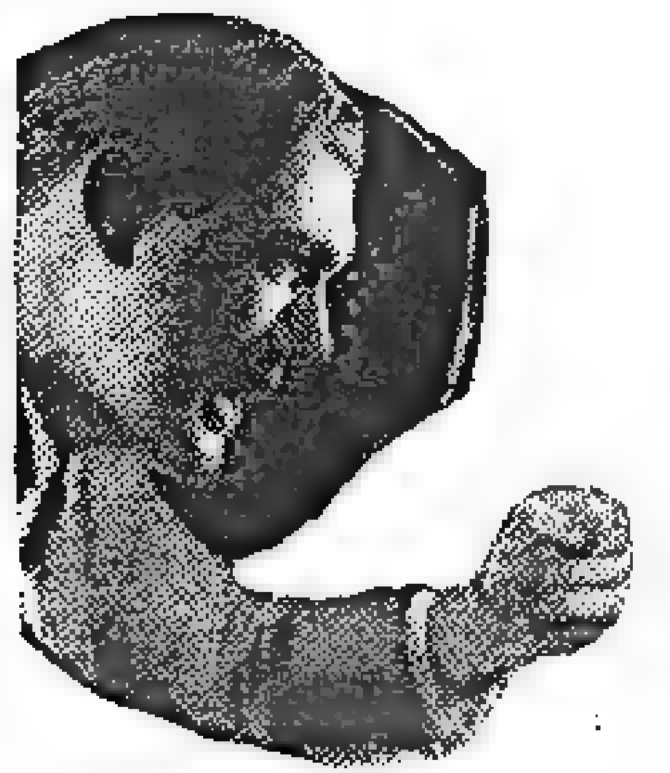

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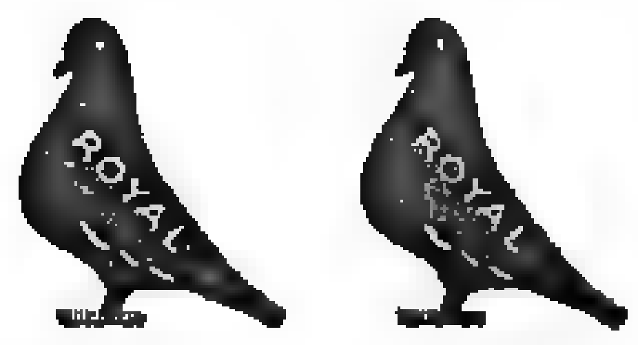

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MODERN MECHANIX PUBLISHING CO.
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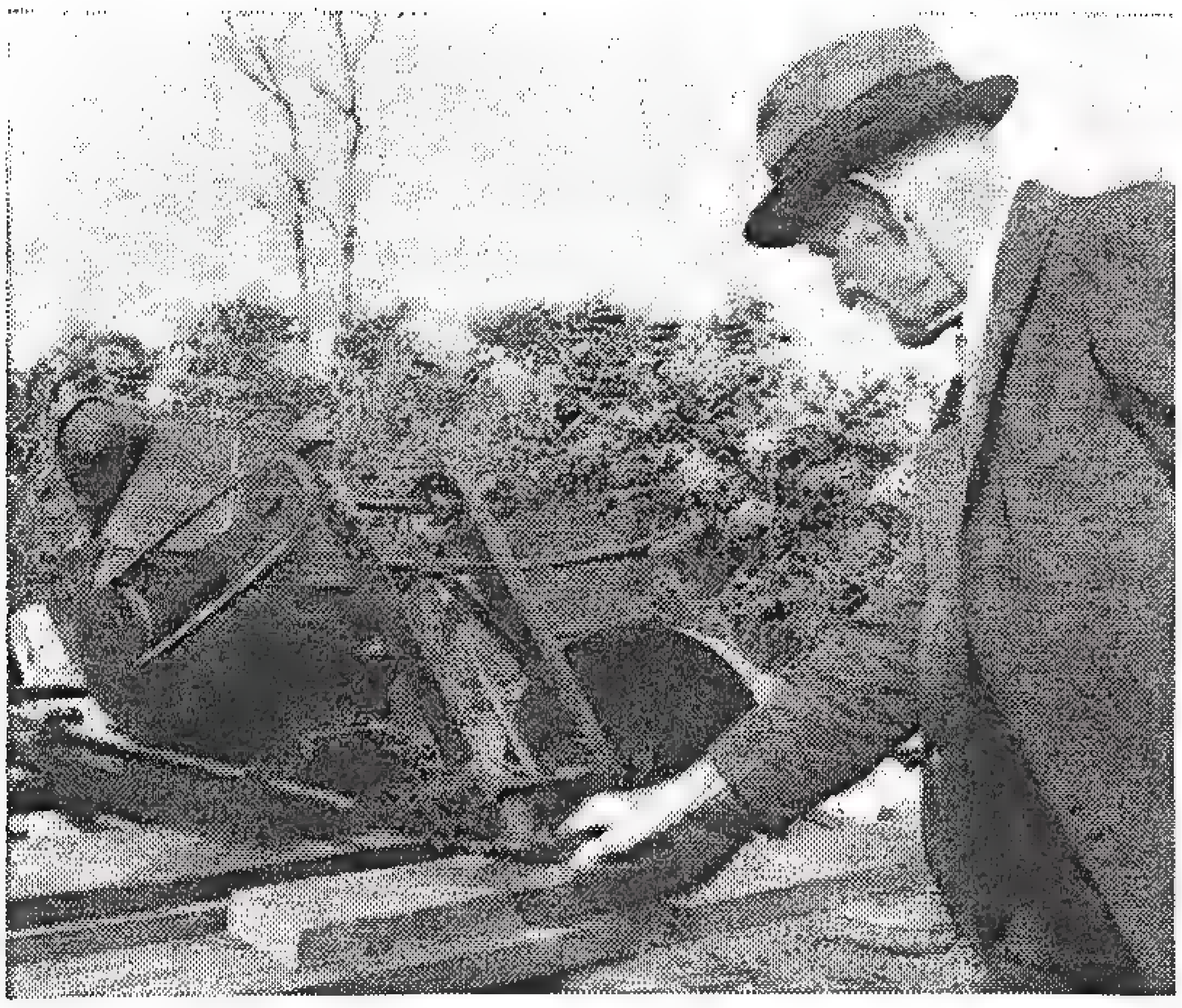
Editor's Workbench Chips

[*Continued from page 29*]



Built by Charles Fottler, this practical power-driven saw is capable of sawing lumber up to four inches in thickness. It is pivoted on a bench so it can be operated at many angles.

Dear Editor:

I am sending you a photo of a sawing machine that I built last winter. It is powered by a 1½-horsepower gasoline engine and cuts lumber up to four inches in thickness.

The saw is pivoted to a bench so that it can be set to cut lumber of any length at various angles. The engine, of course, is stationary. One gallon of gasoline runs it for eight hours.

Charles Fottler

Practical projects always interest MM readers and we wouldn't be surprised if Mr. Fottler receives many letters asking for full details of his home-built power saw.

***

Now is the time of the year when home craftsmen should check over their workshop. making a list of all tools and other equipment such as to ascertain just what items are needed in order to bring the "shop" up to maximum operating efficiency. For mechanically minded readers, no project presented in MM is too difficult to tackle. whether it be an off-shore sailing cruiser. a midget racer, or a simple model plane, provided the proper tools are at hand. It is not always a question of how many tools you have, but how good are the tools. Build up your workshop, tool by tool, but make sure you purchase such equipment from nationally advertised manufacturers who have reputations for producing quality products and who will treat you fairly.

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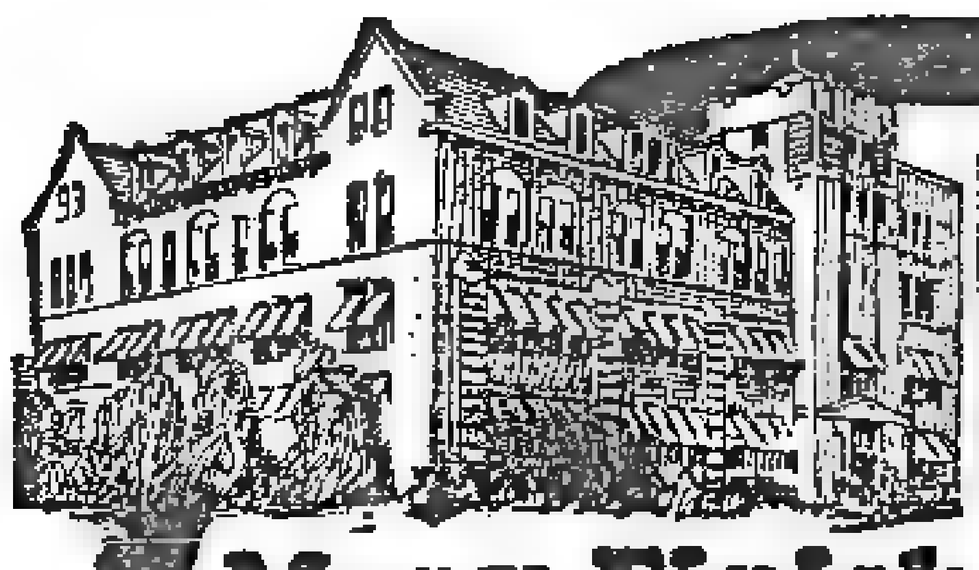

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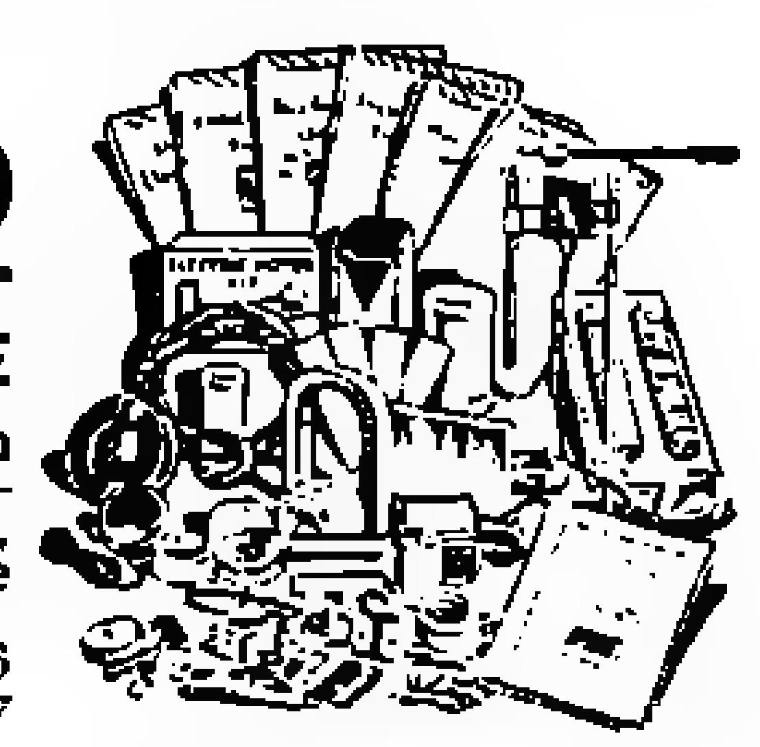

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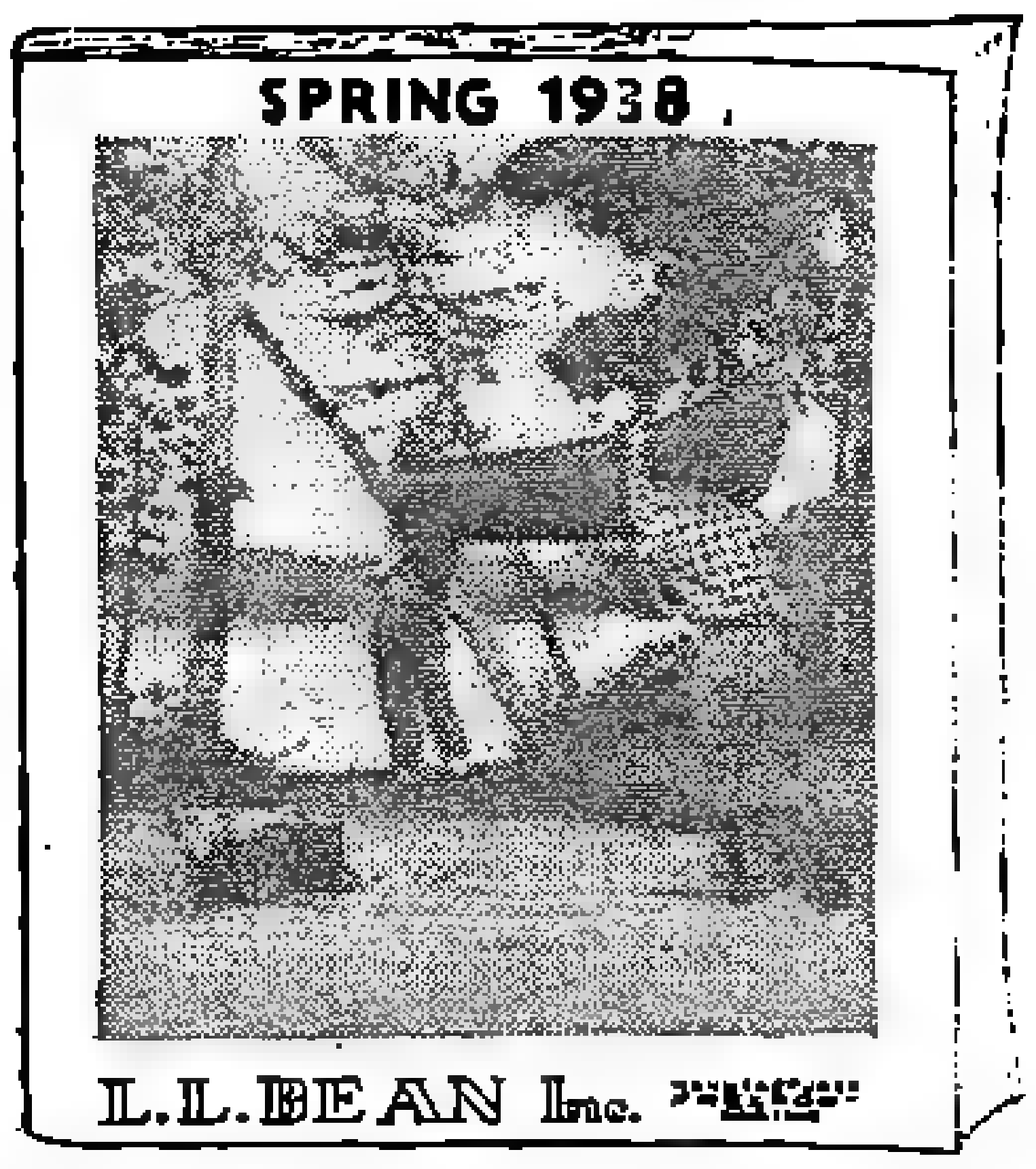

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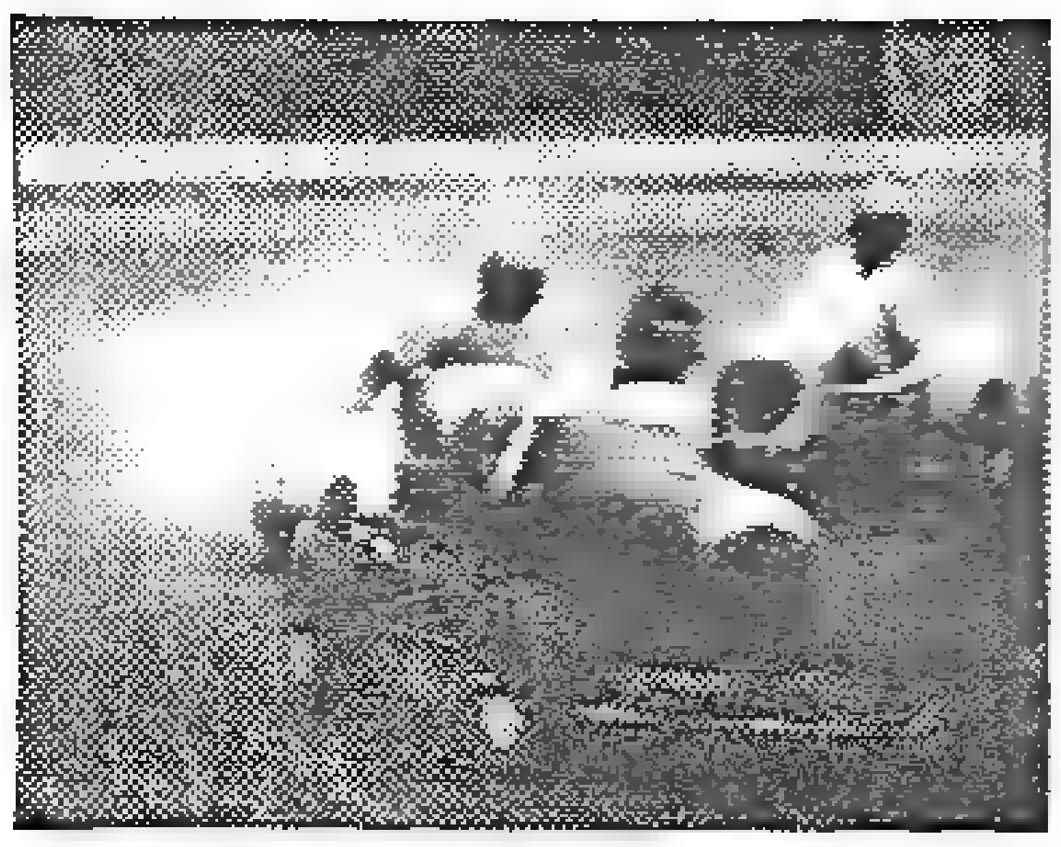

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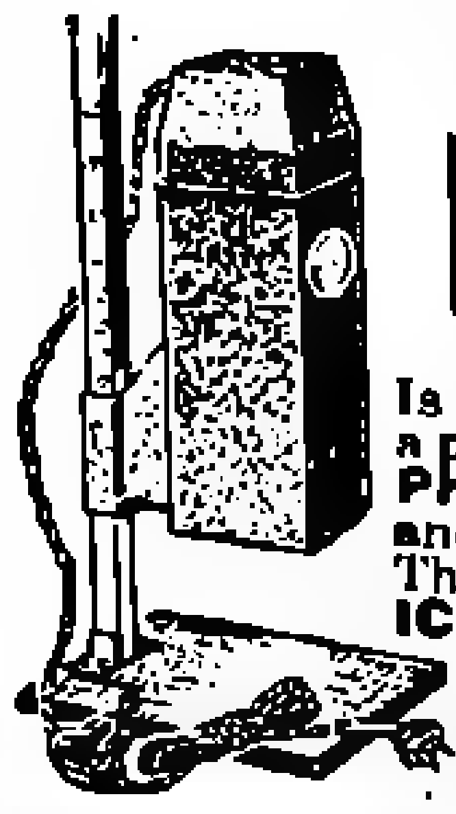

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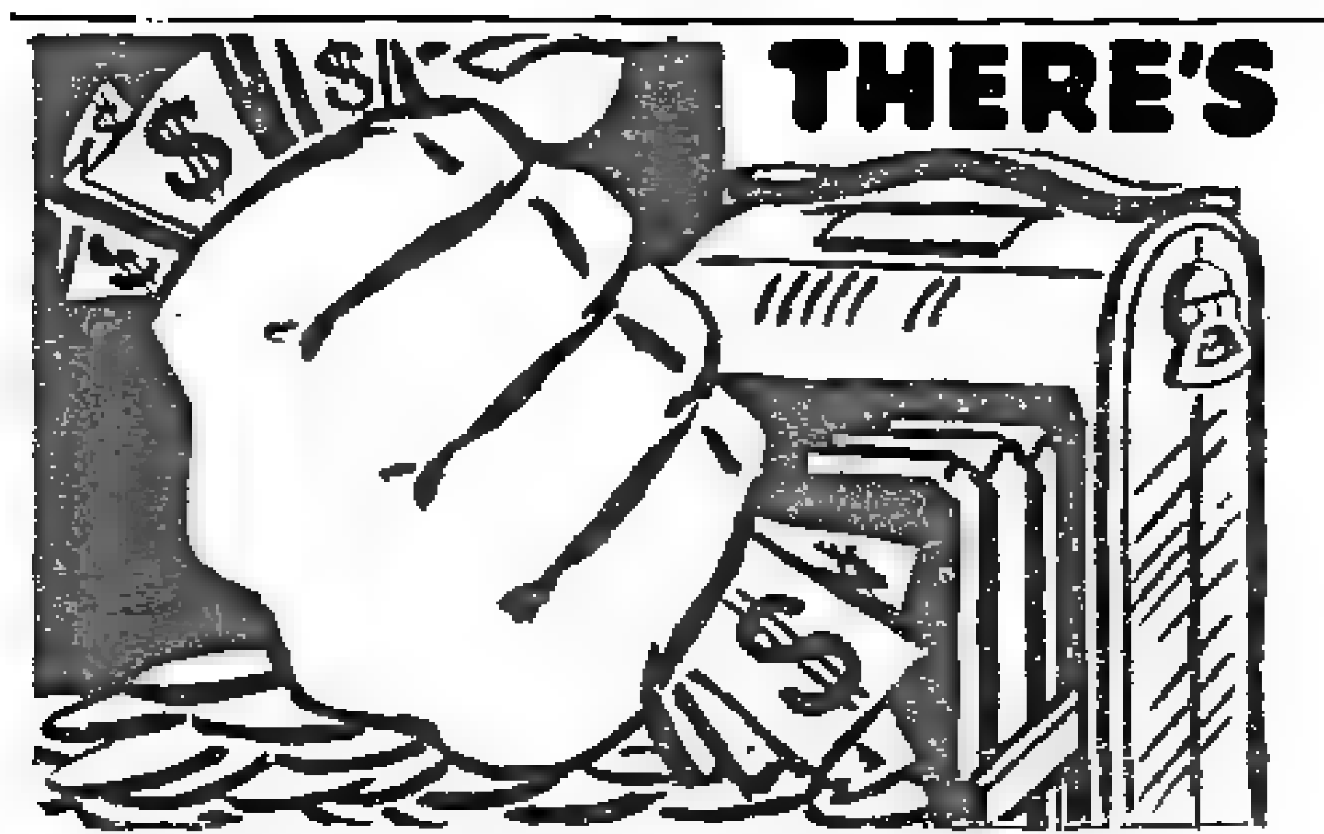

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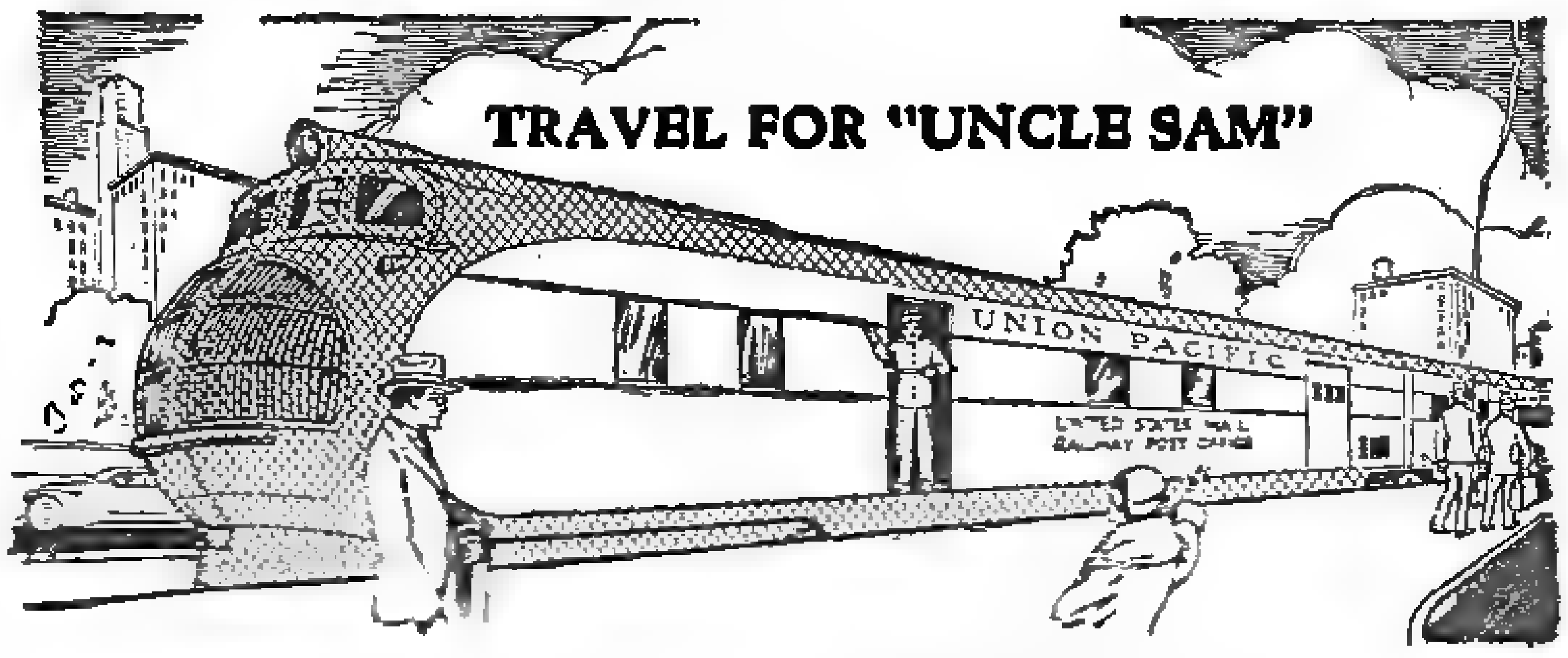
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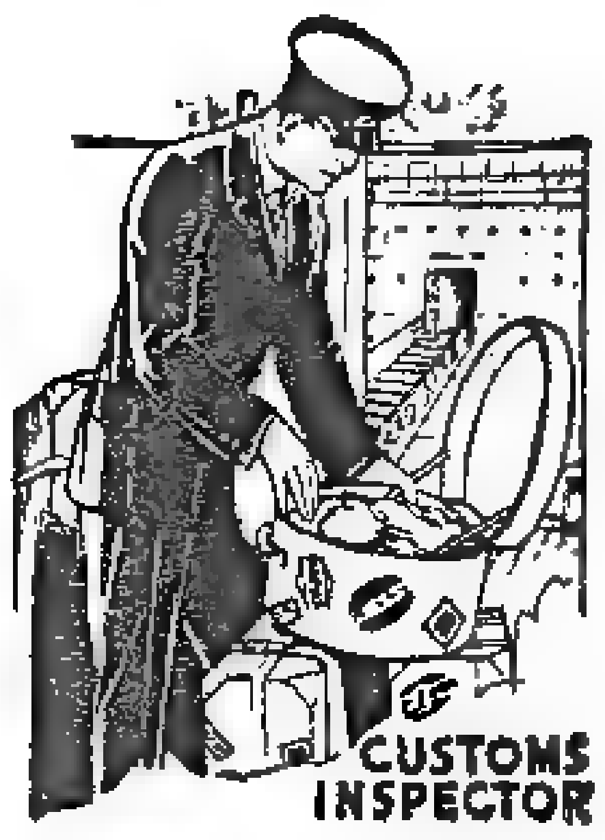

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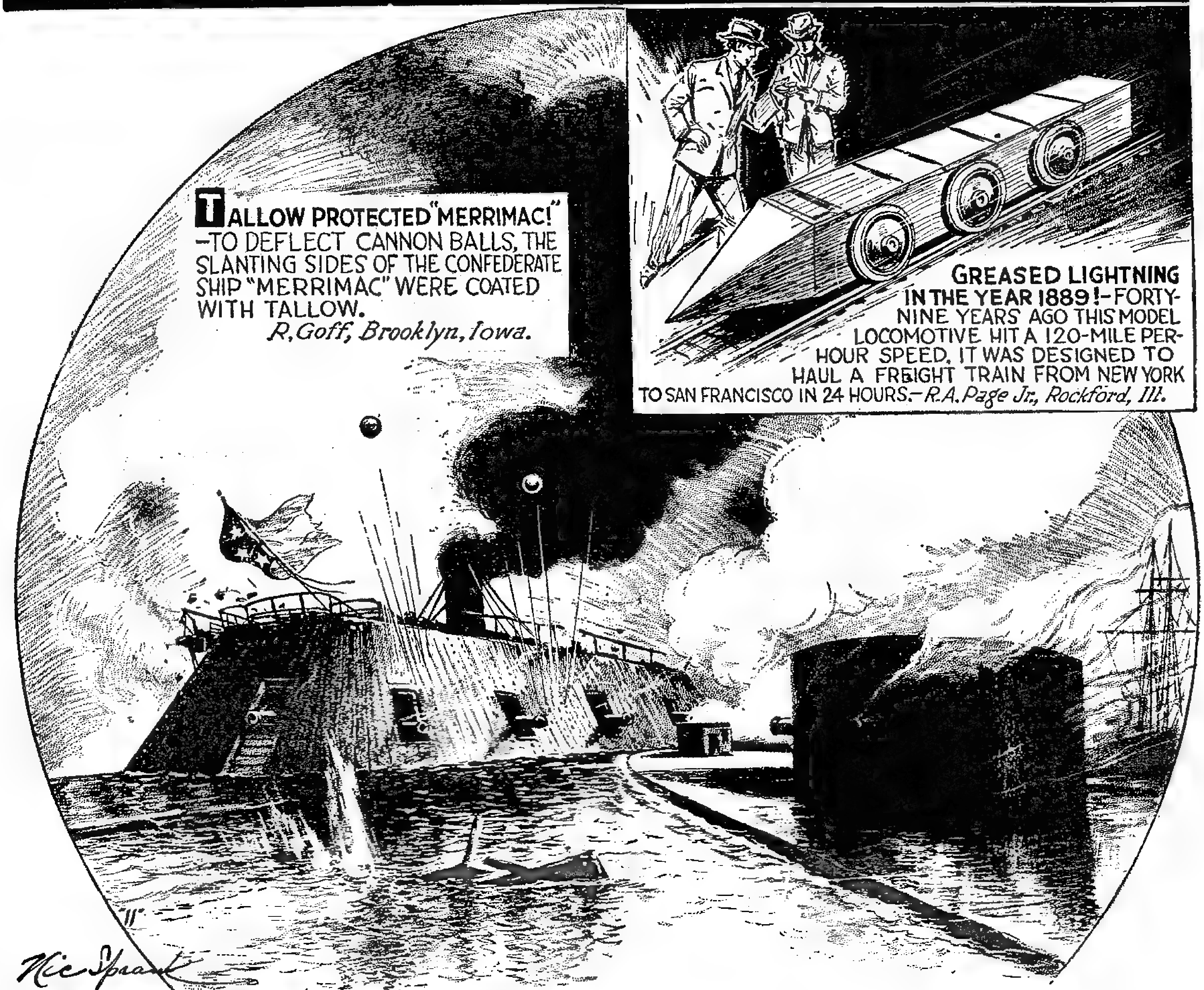
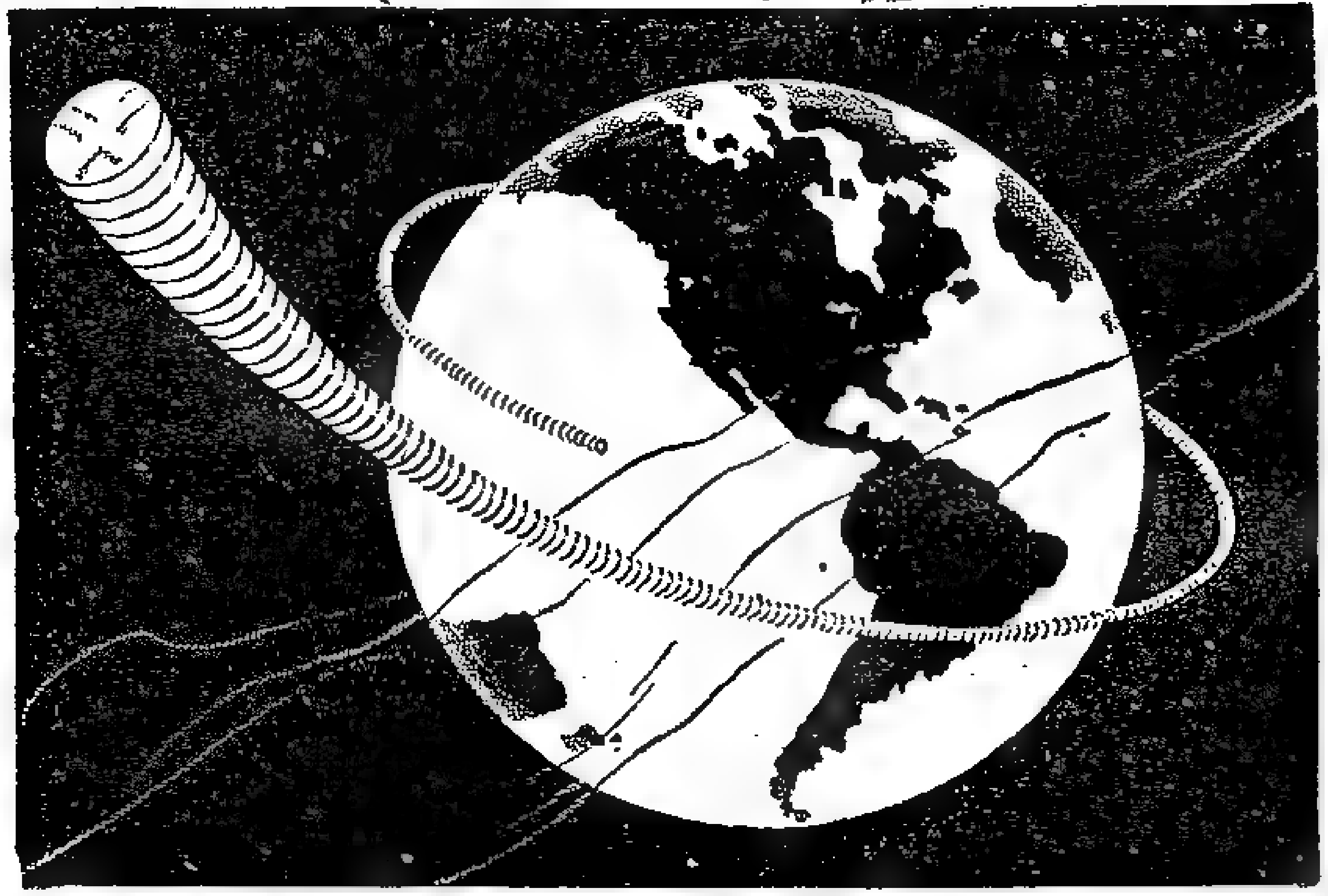
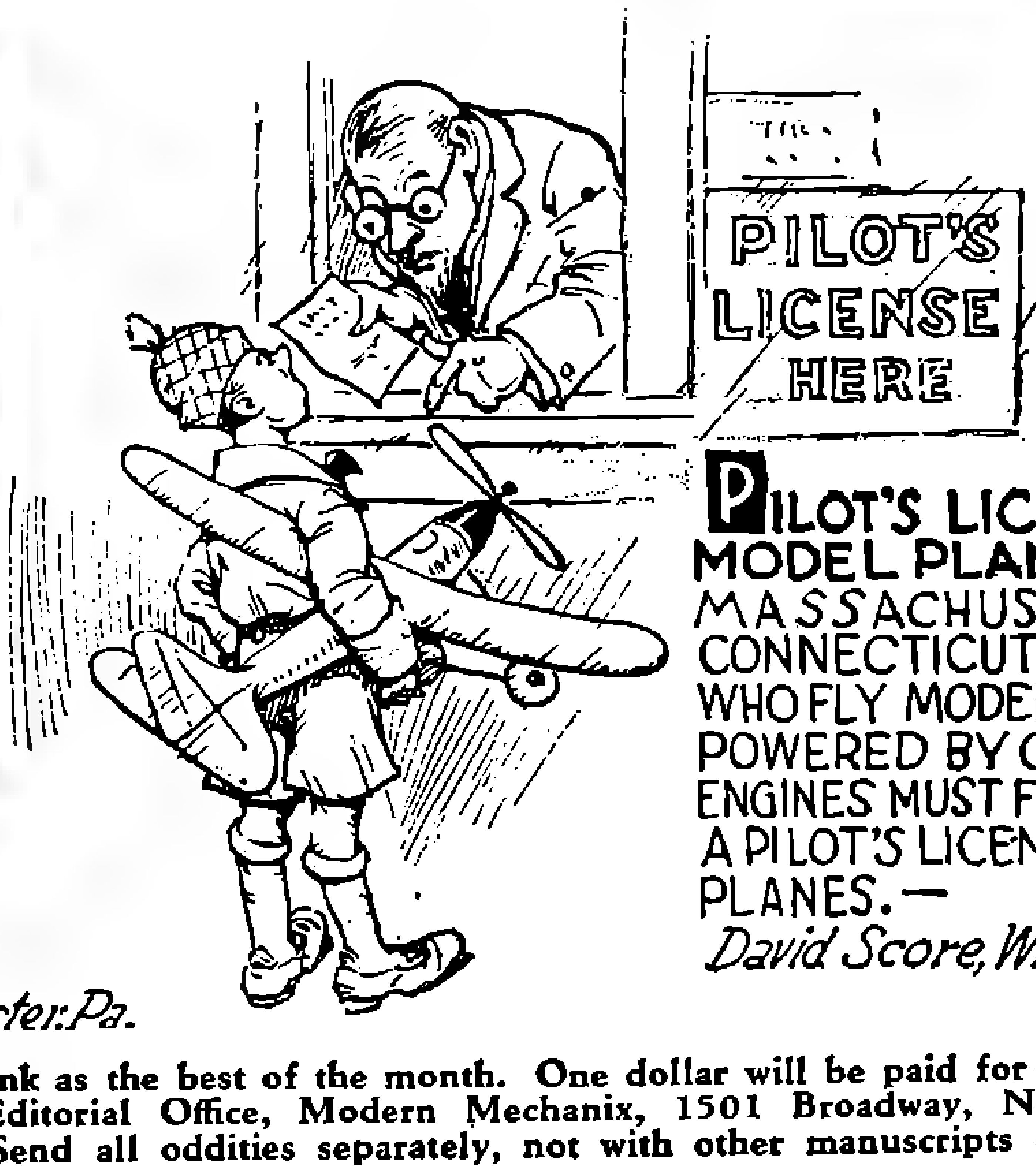


TALLOW PROTECTED "MERRIMAC!" —TO DEFLECT CANNON BALLS, THE SLANTING SIDES OF THE CONFEDERATE SHIP "MERRIMAC" WERE COATED WITH TALLOW.
R. Goff, Brooklyn, Iowa.

GREASED LIGHTNING IN THE YEAR 1889!—FORTY-NINE YEARS AGO THIS MODEL LOCOMOTIVE HIT A 120-MILE PER-HOUR SPEED. IT WAS DESIGNED TO HAUL A FREIGHT TRAIN FROM NEW YORK TO SAN FRANCISCO IN 24 HOURS.—*R. A. Page Jr., Rockford, Ill.*



A YEAR'S SUPPLY OF ASPIRIN!— THE ASPIRIN COMSUMED YEARLY IN THE UNITED STATES, IF PLACED END TO END, WOULD STRETCH 29,553 MILES, OR MORE THAN ENOUGH TO ENCIRCLE THE EARTH.—*V. Brientuall. Chester. Pa.*



PILOT'S LICENSE FOR MODEL PLANES!— IN MASSACHUSETTS AND CONNECTICUT PERSONS WHO FLY MODEL PLANES POWERED BY GASOLINE ENGINES MUST FIRST OBTAIN A PILOT'S LICENSE FOR REAL PLANES.—
David Score, Winthrope Mass.

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Volume XIX
No. 6

MODERN MECHANIX

APRIL
1938

W. H. FAWCETT, Publisher

WAR MACHINES

NEEDED BY THE UNITED STATES

by
Robert W. Gordon

BETWEEN the well-meaning idealist who would have us disarm completely in a world that is arming to the teeth, and the alarmist who sees our cities wiped out in a day, there seems to be a wide divergence of opinion as to just what our defensive needs really are. Before the question can be intelligently decided, before the taxpayer can be sure he is getting adequate war insurance at the minimum premium, it is necessary to define what we mean by "defense."

There are several ways in which the United States might be drawn into war. For instance, there is Alaska, a vast sprawling treasure house, rich in gold, silver, copper, coal, oil, lumber, fish, seals and reindeer. At this writing, Japan is already raiding our salmon fisheries. If she gets away with this, might she not be encouraged to appropriate the oil fields, which she desperately needs?

Certainly we would defend Alaska.

Then there is the Panama Canal which, in addition to its enormous commercial advantages, saves us the expense of maintaining two fleets. We would fight to prevent the canal from being destroyed or falling into foreign hands.

And the Hawaiian Islands! We would never permit a foreign power to seize them and thus establish an important base off our Pacific Coast.

Getting out of the realm of fact, into that of political speculation, would we enforce the Monroe Doctrine in case of an aggressive move by a foreign power in either Central or South America?

Would we feel obligated to defend the Philippines, shortly to attain their independence?

Would we defend our trade and citizens in foreign countries or traveling on the high seas?

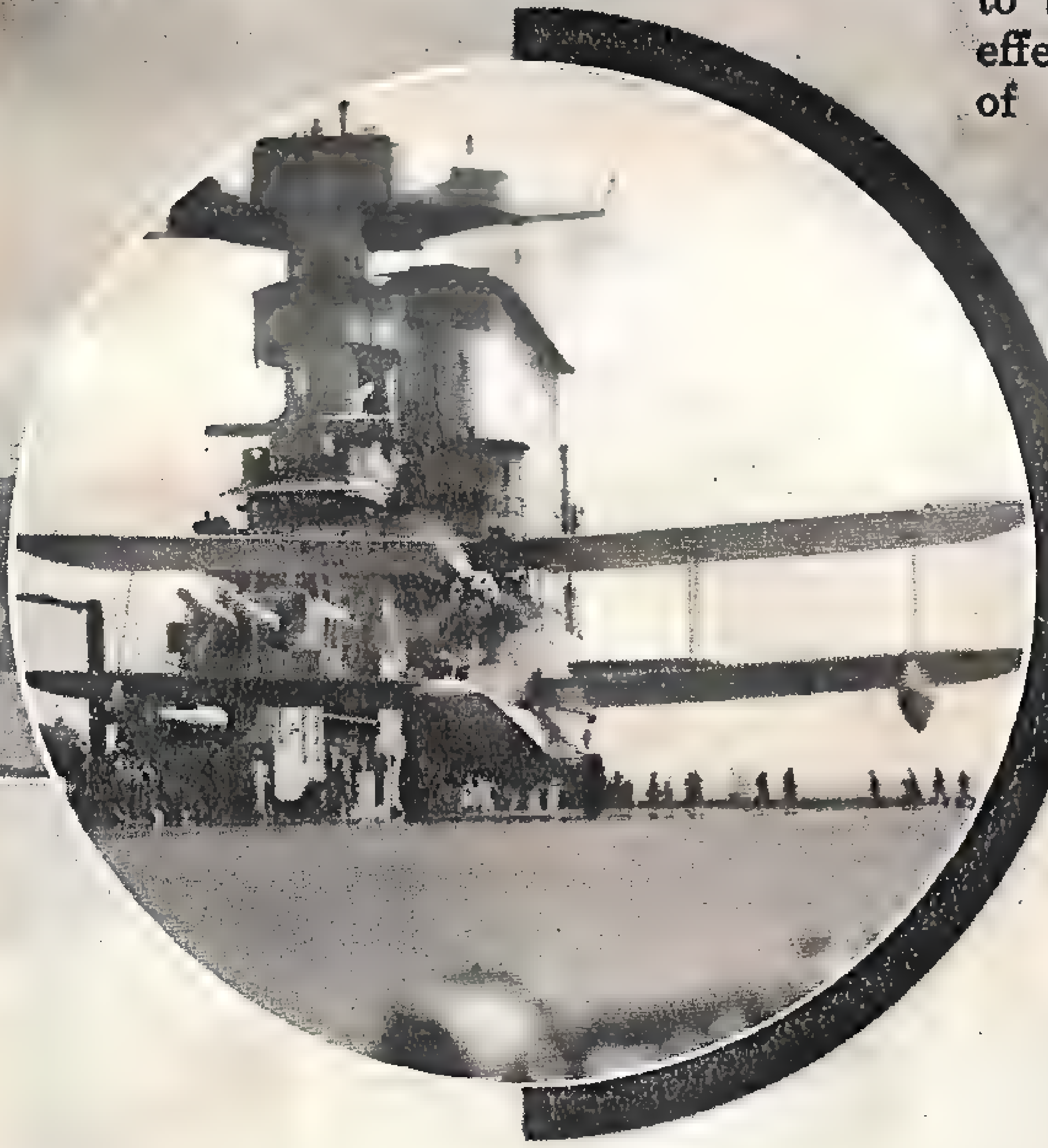
Would we again attempt the role of defenders of democracy throughout the world, as we did in 1917?

The continental limits of the United States are not in much danger of being invaded—as long as we have our fleet, now the second largest in the world.

The time may come when an invasion by air is possible, but we need not worry about that now. Planes can now fly the Atlantic in one jump, but none can make the round trip, carrying a worthwhile load of bombs one way. Any troops that could be flown across could be handled by the local police.

Invasion of the United States, it is generally conceded, would have to come by sea. And no such invasion would ever be attempted as long as our fleet was in existence, unless it should be caught in the wrong ocean and held there by destruction of the Panama Canal. The Canal, for this reason, needs to be made impregnable. Its present defenses consist of a mobile brigade to repel landing parties, our air force, anti-aircraft artillery, and coast defense guns, which are adequate to protect it from a raid (unless it should be a surprise raid made before a declaration of war). Its major defense is the Navy itself, which alone can prevent a major operation against it, since such an attack would have to be made by sea. It could, however, be effectively blocked by the simple expedient of blowing up a ship passing through it (which would have to be done before a declaration of war).

A second canal, the projected one through Nicaragua, would be an excellent defensive investment, far less costly than building a second fleet, or attempting to expel an invader once he had a foothold. But a fleet cannot remain afloat indefinitely. It must have bases where it can retire for repairs, refueling and to re-



Realizing the value of aircraft as fighting and scouting auxiliaries, the U. S. Navy has added another carrier, the *U. S. S. Yorktown* (below), to its fleet. Circle—Taking off from the flight deck of the *U. S. S. Lexington.*

plenish its ammunition supply. Such bases must be strongly defended by anti-aircraft and coast defense guns, and a land force strong enough to repel surprise raids aimed at their destruction. We have four such bases at New York, Norfolk, Puget Sound and Pearl Harbor. We have an undefended base at Guantanamo Bay, Cuba, which should be fortified, for it is vital to the defenses of Panama. Since the Key West—Havana route is the line of supply for Guantanamo, Key West should also be strongly fortified. We also need another base on the west coast. Complete docking facilities are all that is necessary to make San Diego such a base.

It has been frequently asserted that a navy is obsolete, since an airplane bomb can sink any ship. This has yet to be proved, for no first line battleship has ever been sunk by an aerial bomb. In the Battle of Jutland, 50 capital ships hurled big caliber shells at each other for hours, yet only one battleship was sunk (there were 24 other ships sunk, but all were cruisers or lighter craft). A 14-inch shell and a one-ton bomb are about equal in destructive effect, the shell having a greater armor-piercing quality. Long-range shell fire falls almost vertically, and decks are armored to withstand such fire—there is no reason to suppose they cannot stand up as well against bombs. A well-placed bomb can, of course, sink any other type of ship.

The submarine battleship controversy is in the same category. No capital ship has ever been sunk by a submarine. Battleships have "blisters" (false sides) below the waterline to explode torpedoes before they can do serious damage, the hulls are minutely subdivided as well to localize the damage of any penetration. Besides, battleships never operate without their protecting screen of destroyers, which, with their hydrophones, depth bombs, and great speed, are more than a match for any submarine.

So the Navy needs battleships because they are the only type of ship that can fight other battleships. It needs cruisers—fast long range ships—to fight off lighter craft, and to scout and locate the various components of the hostile fleet.

The Navy also needs destroyers as protection against submarines, to make fast torpedo attacks against the hostile line (too many torpedoes, just as too many shells or bombs will sink even a battleship), and to lay smoke screens in front of the big ships to prevent accurate, aimed fire from the enemy's surface craft.

Because of such smoke screens, as well as because of the extreme range of big guns, battleships must have airplanes for

Although it is claimed that submarines have never sunk a capital ship, their ability to observe enemy ports and coasts unseen while operating against merchant marine vessels has resulted in the building of more underseas craft by foreign nations, as well as by the United States. One of Uncle Sam's submarines, the *P-1*, is shown below. Circle—Obsolete World War equipment is still used by the U. S. Army Signal Corps for training purposes due to lack of modernized apparatus.

spotting their own shell fire. To protect the spotting planes, fighting airplanes are needed, and for this reason we must have enough airplane carriers to transport these planes, which can also be used for bombing and scouting operations in co-operation with the fleet.

Although submarines aren't much good in fleet operations, they are needed for observing enemy ports and coasts unseen, for helping to locate the enemy fleet, and for operating against lone ships of inadequately protected convoys.

Various types of auxiliary ships, such as airplane, destroyer and submarine tenders are needed. Such ships operate with the fleet and are capable of performing almost any repair, no matter how great, for the craft they are designed to service. Other ships, such as oilers, ammunition ships, store ships, ocean tugs, hospital ships, mine-layers and mine-sweepers are also needed. Our Navy is said to be particularly deficient in these auxiliaries at present.

Any one or several of these types of ships could be dispensed with, if other naval powers dispensed with theirs, but to be deficient in any one type would invite defeat in case of war. There is no such thing in warfare as second prize. You either win or lose. Our Navy should be strong enough to win within its own operating range. This operating range is the distance from the base in which it can operate as a complete unit, and is limited to the range of destroyers, which is 2,500 miles.

Though the Navy is the first line of defense, we cannot afford to depend upon it alone. Should it be defeated, should it be afloat in the wrong ocean through the blocking of the Canal, or should we be attacked simultaneously by a European and Asiatic power, we would have to count on our other arms.

The Air Corps would be the first to see action. Highly mobile, our entire fighting force could be assembled at one point within 24 hours. In an action near our shores the long range bombers (of which we now have the best in the world) could patrol the seas, either alone or in conjunction with the Navy. Having discovered an approaching force they would attack with bombs, but it is doubtful if the Air Corps alone could prevent a landing, either on our own shores or in adjacent Canada or Mexico. A landing force would then have to be expelled by adequate forces representing all service arms.

Used for reconnaissance by officers, armored cars like the one shown at left are helping to modernize our army. However, great numbers of these cars, as well as other mechanical equipment, is needed to fully modernize the Regular Army.

●

Supported by aircraft and naval operations, this battery of 155 mm. general purpose guns (lower left) would play an important part in defending Hawaii in event of war. Below—Not a man from Mars, but a soldier with a new type gas-proof suit.

Much more likely than this sort of a war, though, is an invasion of Alaska or the Philippines. There is little question that we would fight in either event, yet we are now inadequately prepared to resist such an invasion. Our Naval base at Hawaii is 5,000 miles from Manila and about 2,000 miles from southern Alaska.

If we plan to hold Alaska, we need a naval operating base at Dutch Harbor, and an Air Corps base farther inland, with the necessary coast and anti-aircraft defenses, plus enough ground troops to resist any landing attempts near these bases.

We do not need a large army, but the one we have should be highly trained, and equipped with the best weapons available. While our Springfield rifle is the best military rifle in the world, the fire power of the infantry could be increased five times, by equipping them with semi-automatic rifles. We now have only 3,000 such rifles. We should have at least 50,000.

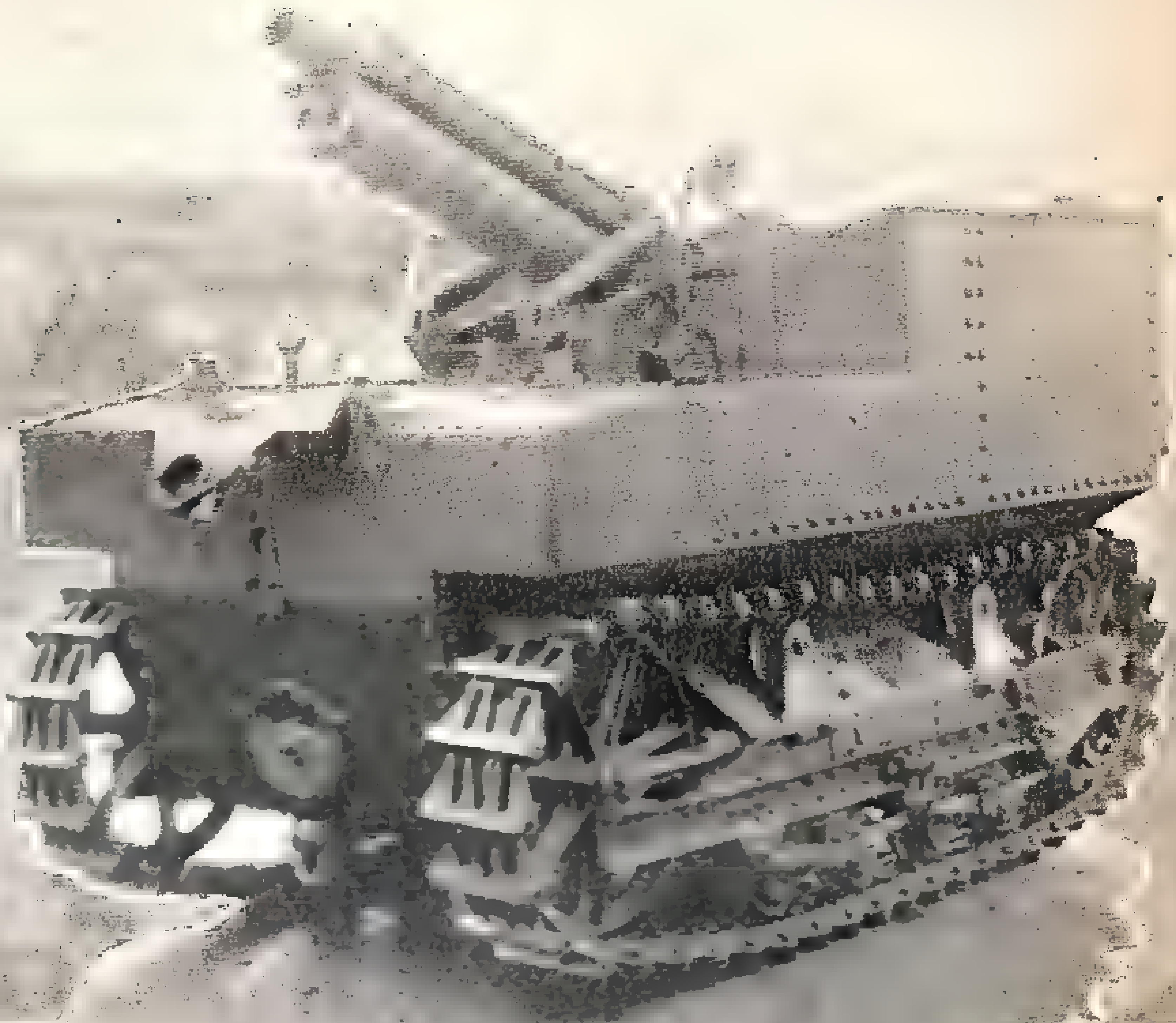
Until recently our Army had only six modern tanks—not nearly enough for training purposes. This amazing deficiency has been remedied, but we still need more. Two hundred would be a conservative minimum in view of world affairs.

We have four thousand '75's left over from the World War. An excellent weapon in its day, we have since developed a field piece that weighs the same, yet fires twice as far; and it can be towed at fifty miles an hour behind trucks. The old wooden-wheeled gun is damaged if towed faster than eight miles an hour. We need to equip our regular army artillery units with these modern guns and this is rapidly being done.

Anti-aircraft artillery, surely a defensive weapon, has been wonderfully improved since the World War. We need to equip our anti-aircraft Regular and National Guard regiments with the latest in these types of defensive weapons.

In short, all of our Regular Army and National Guard units should be supplied with enough of the latest equipment to enable them to take the field at once, as a modern force. There will be time enough to equip a large wartime army while we are training the men, but our permanent force should be the best trained and best equipped force of its size in the world. Only if it is so can we afford to keep it small. There should be enough ammunition of all calibers in reserve, to last our regular forces for 30 days.

[*Continued on page* 118]

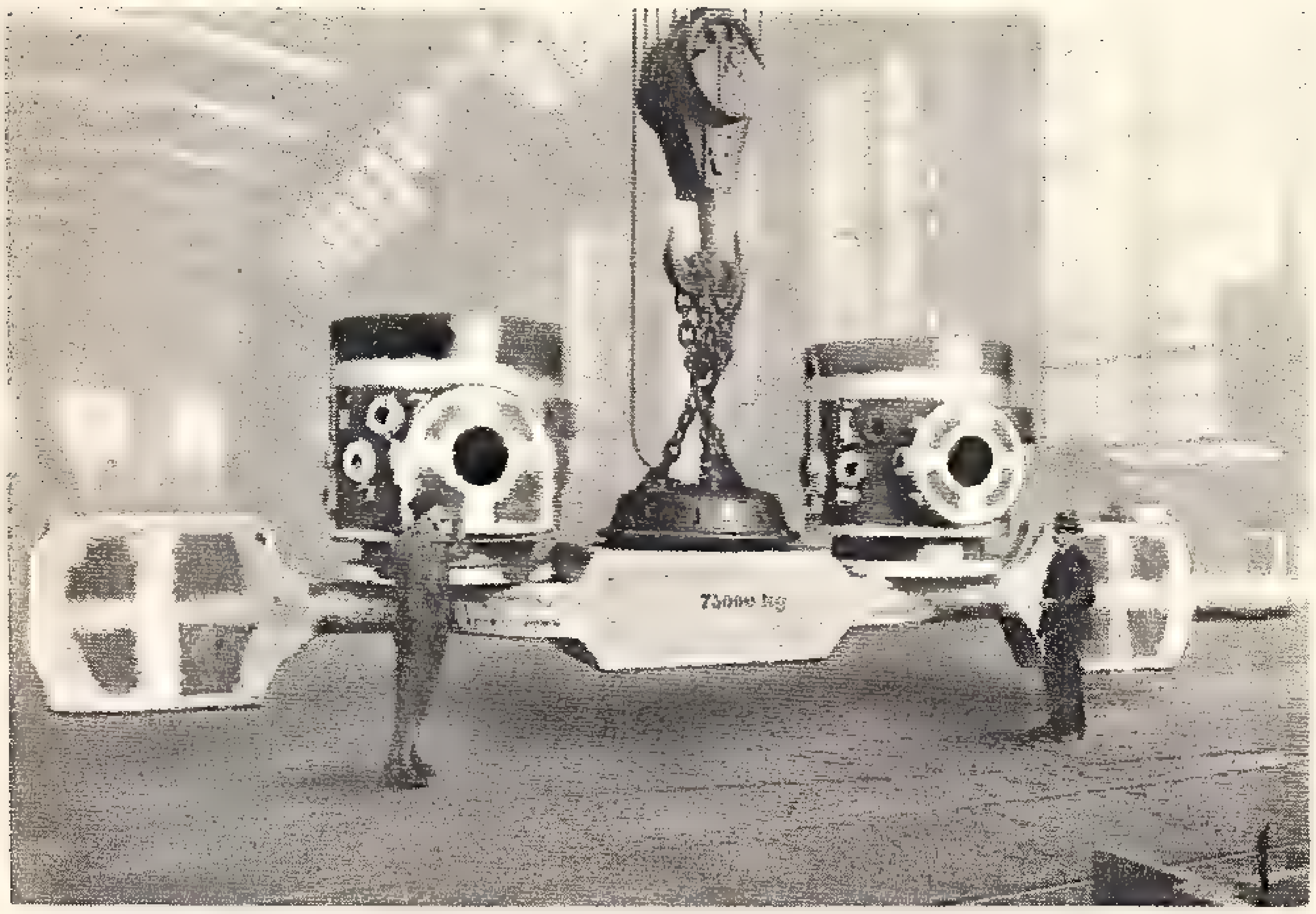


Designed to provide artillery support for advancing infantry, 75 mm. howitzers mounted on caterpillar-tread trucks (upper right) can follow the troops even though the ground is torn up by shell fire. As part of our defense plans, it is urged that factories manufacturing mechanical military equipment be encouraged with sample orders in order to keep production machinery and tools on hand.

●

The mobility of aircraft has made them an important part of the defense plans of the United States. Shown at the right is a formation of Boeing "flying fortress" airplanes in flight over New York City. Powered by four 1,000-horsepower engines, a squadron of these bombers recently demonstrated their ability to speed to the aid of any section of the country by making a transcontinental flight in eleven hours and two minutes.

Electro-Magnet Lifts Metal Load Weighing 83 Tons



Possessing powerful attraction, the electro-magnet shown here successfully holds metal forgings weighing up to 83 tons. The magnet is installed in a German industrial plant

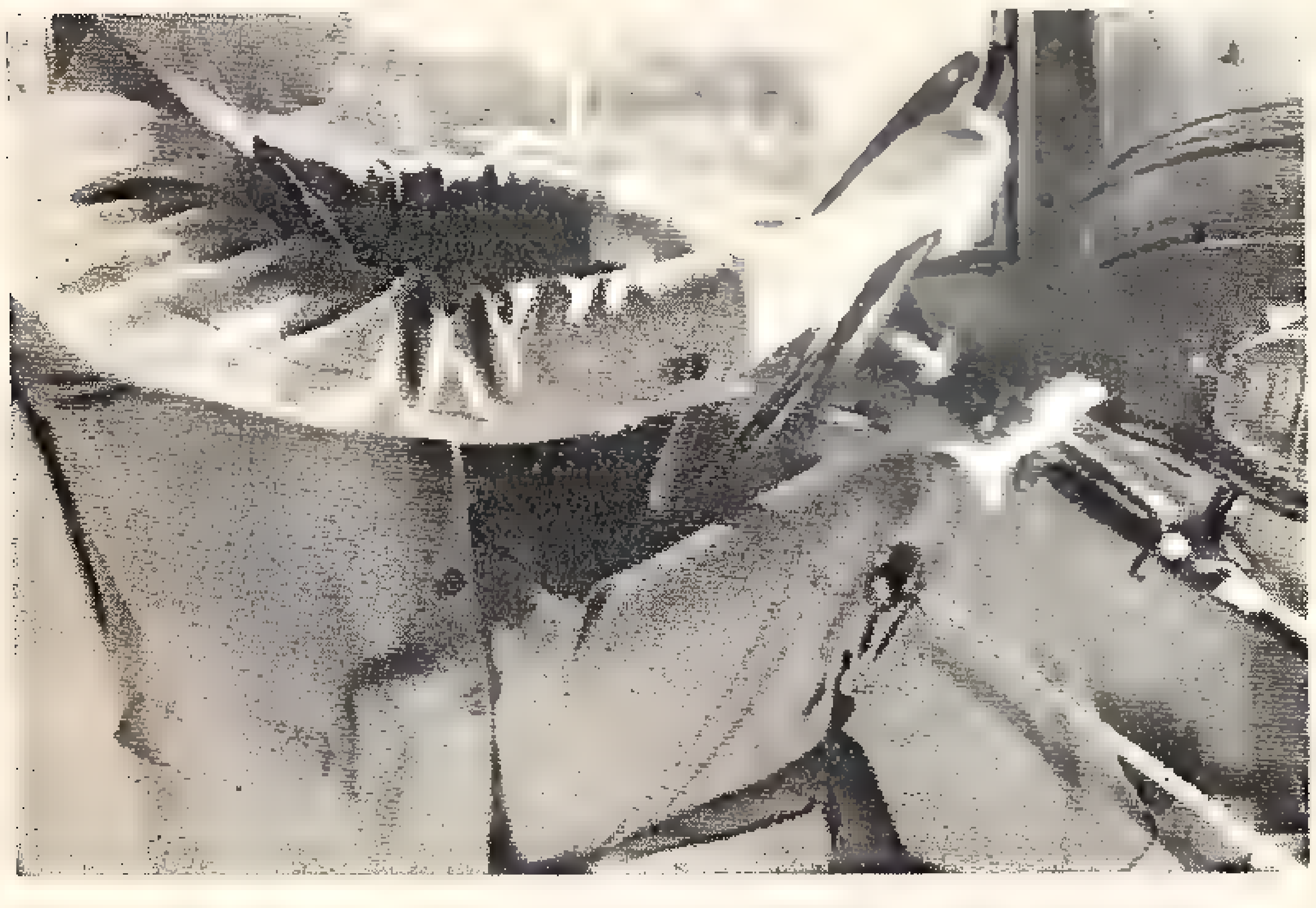
INSTALLED in an industrial plant in Essen, Germany, a huge electro-magnet is said to lift loads of metal forgings and castings weighing more than 83 tons. The magnet is a circular type with a diameter of more than five feet.

The powerful magnet is attached to an overhead conveyor by means of chains and hooks and is used to transport the heavy forgings from one part of the plant to another without interfering with workers operating machines on the floor below.

Knee Throttle Eases Driving

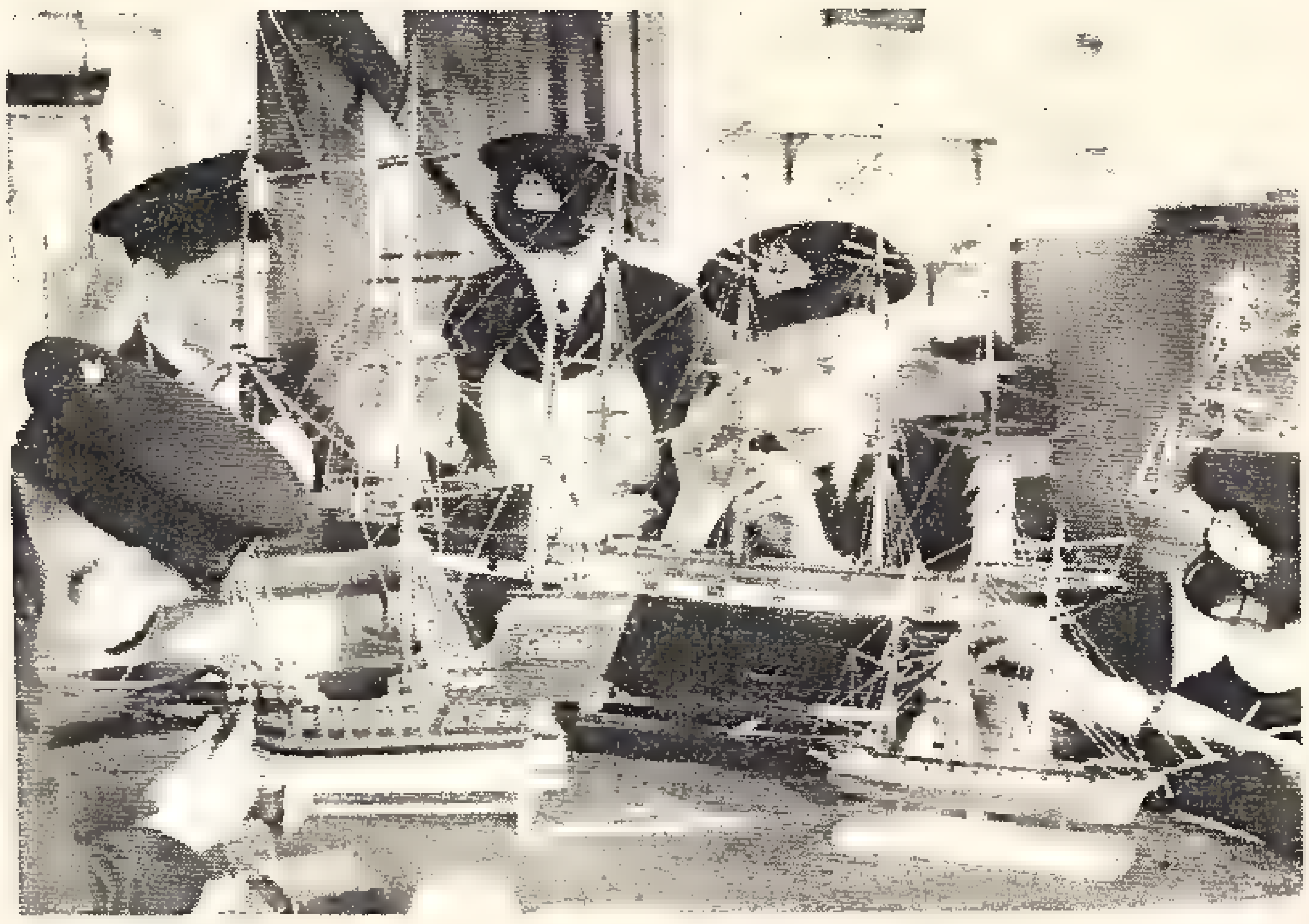
RELIEVING the strain on the right foot and leg when driving long distances, a newly developed knee-operated automobile throttle actuates the regular foot accelerator, permitting the foot to rest comfortably on the floor. The knee-accelerator is attached to the steering post and is controlled by pushing the side of the knee against it. The gasoline feed is cut off when the knee pressure is relaxed, switching control to the regular foot accelerator.

The knee accelerator is easy to install on any automobile and is of simple, but sturdy, construction. When not in use, the felt-padded knee pedal can be swung downward along the steering post so as to be out of the way when entering or leaving the auto.



Easily installed on any auto, this knee-operated accelerator relieves strain of holding foot on usual gas pedal.

Cadets Build Miniature Ships



Building ship models is part of the training which cadets must complete before they can become British Naval officers.

BOYS attending the Nautical College in Reading, England, in preparation for careers as officers in the British Merchant Marine Service or Royal Naval Reserve, are required to construct scale models of full-rigged sailing ships as part of their training. The models must be complete in every detail.

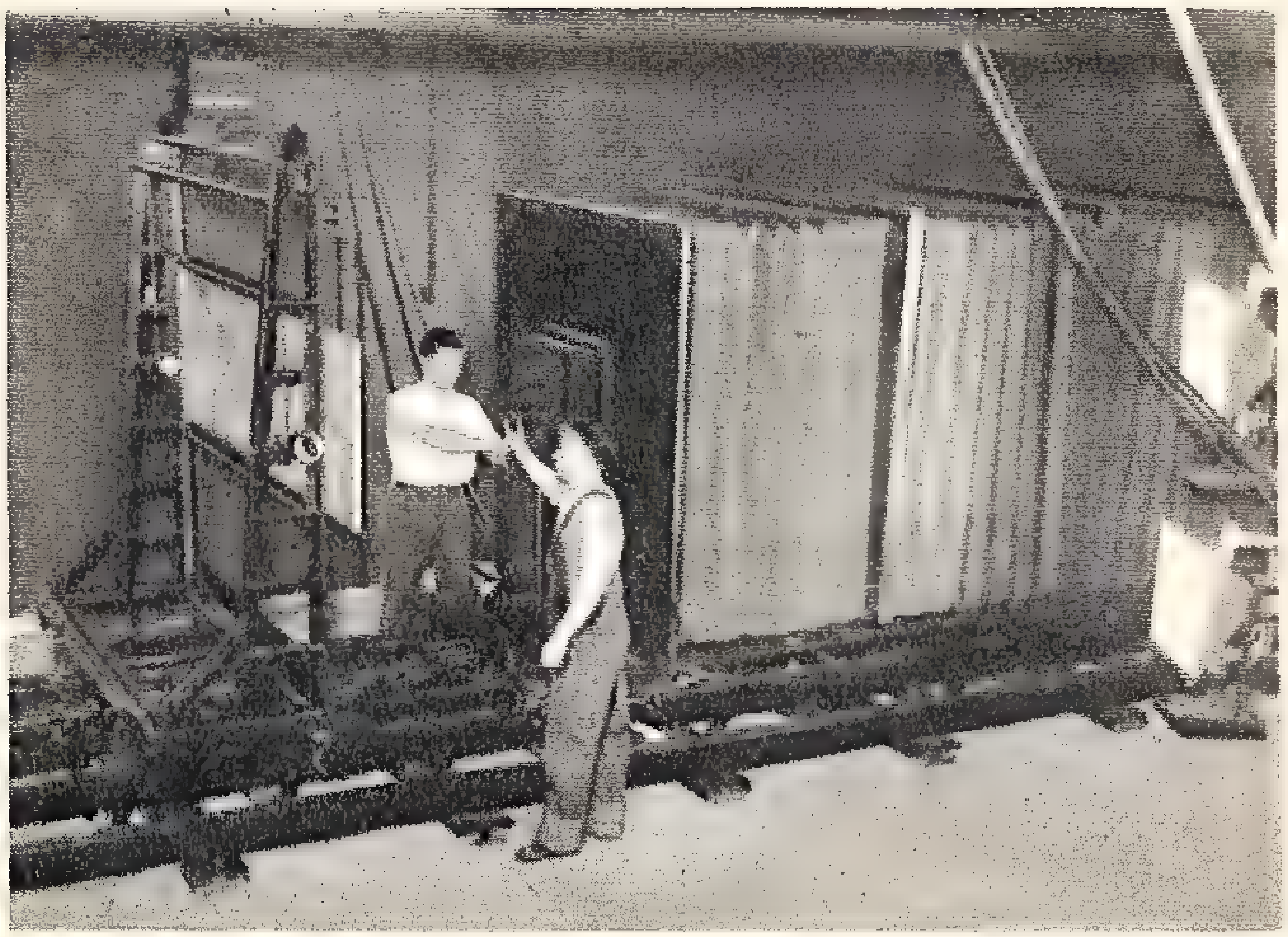
Carbon Socket Saves Lamp

DESIGNED specially for use in the chemical industry, where the proximity with corrosive substances causes a metal-capped electric light bulb to deteriorate long before the filament has been burned out, lamp sockets of synthetic carbon have recently been developed. The carbon is not readily attacked by chemical reagents, insuring longer life for the lamps.

Mammoth Process Camera Has 20-Foot Bellows

DESIGNED for color separation work, a process camera recently installed in a Cleveland, Ohio, manufacturing plant is believed to be the largest of its type in the world. The huge camera has a bellows measuring five feet, ten inches by five feet, six inches, which can be drawn out to occupy a space twenty feet long.

Costing $25,000 to build, the mammoth camera is mounted on a slide track together with a focusing easel. Two men are required to operate the camera and powerful arc lamps are used to provide illumination.



Mounted on a slide track which enables its bellows to be drawn out to a length of 20 feet, this process camera is said to be the largest in the world. It cost about $25,000 to build.

New 50 H.P. Airplane Engine

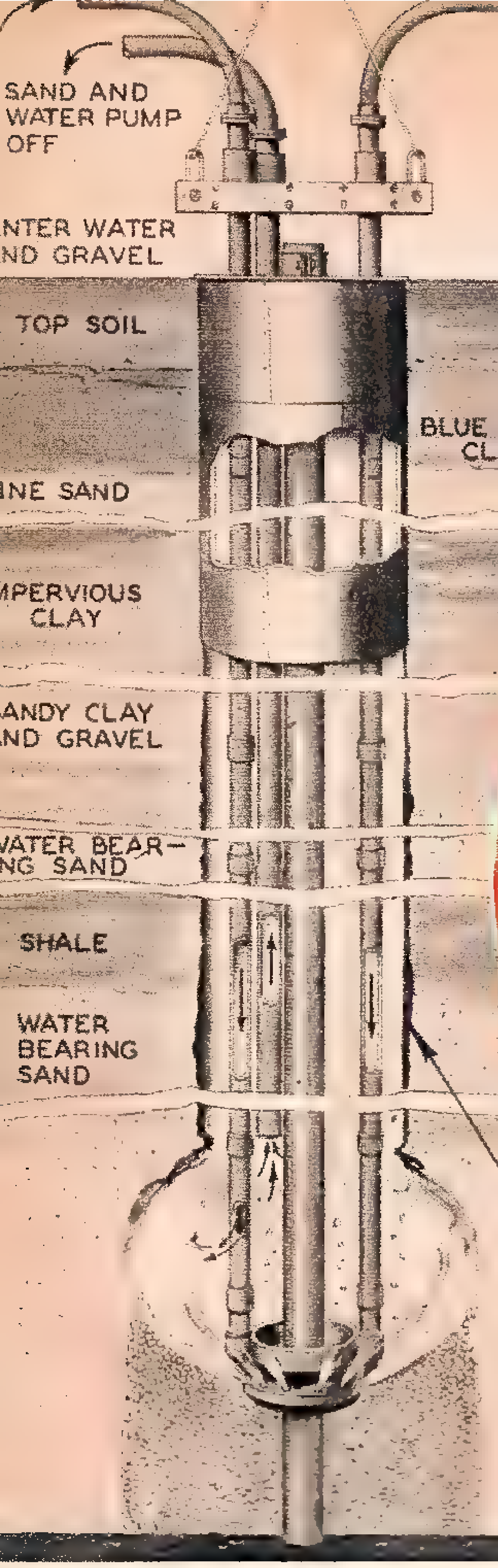
Capable of developing 50 horsepower at 2,550 R.P.M., this engine weighs 156 pounds and is only 27$\frac{5}{16}$ inches wide.

WEIGHING only 156 pounds, a new light plane engine developed by a Los Angeles, Calif., manufacturer produces 50 horsepower at 2,550 R. P. M. The motor is a four-cylinder horizontal opposed type and features a large fin area to provide efficient cooling qualities. Known as the M-50, the compact engine was designed specially to power the various types of "flivverplanes" which have become popular throughout the country. The overall width of the powerful little engine is only 27$\frac{5}{16}$ inches.

Bridge Has Glareless Lights

THE newly erected toll bridge that crosses the Delaware River between Phillipsburg and Easton, Pa., is equipped with special vapor lamps, which are set so as to eliminate shadows and glare in an effort to make night driving as safe as day driving for motorists using the structure. The lighting system has earned for the bridge the honor of being called the best illuminated bridge in the United States. The toll bridge, which accommodates four lane traffic, was constructed at a cost said to exceed $2,500,000. Thousands of dollars were spent for the special lamps.

Night scene on the new Delaware River toll bridge at Easton, Pa., showing the glareless and shadowless vapor lamps used.


SAND AND
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NG SAND
SHALE
WATER
BEARING
SAND
MUD WALL
WATER BEARING SAND
ROCK

Cross-section drawing showing construction of a deep-well reamer. Its operation is fully described in text.

WATER

Deep-well digging ranks as one of the most marvelous of 20th century engineering feats.

Circle—Paul Sweitzer, who is rated as one of the world's foremost authorities on modern scientific deep-well digging.

YOU probably have been thrilled by stories of the big game hunters of the world, by the experiences of horror and death in the frozen North; you may have shuddered over the escape of adventurers penetrating the depths of unknown forest jungles, surrounded by tropical disease, deadly insects and poisoned, hostile arrows, but have you ever thrilled to the story of that tiny stream of water which comes trickling from the tap in your bathroom—the romance of finding it and bringing it into your home?

Roughly a third of the people of the United States use underground water. The agricultural and industrial uses of it are enormous. Daily these uses are growing and modern methods of searching out this water, guaranteeing an ample supply at all times, are among the most marvelous of twentieth century engineering accomplishments.

Imagine, if you can, a 60-inch hole running straight down into the earth for a distance of 400 feet. Sixty inches in diameter means five good feet of earth. In this circular space

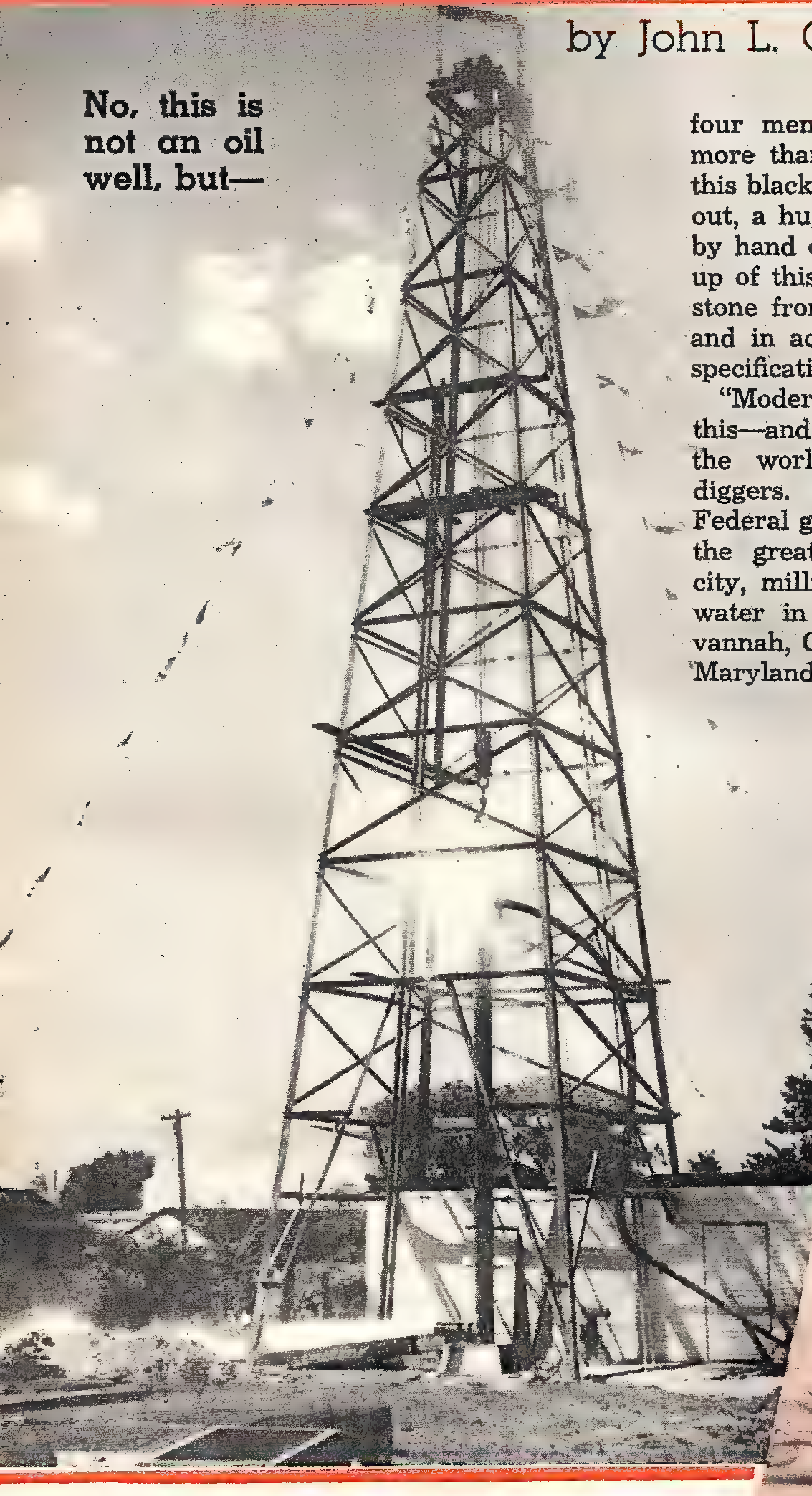
No wonder Mr. Sweitzer (wearing hat) and his assistant are smiling—the water pouring from the pipe during a test indicated that the new well in the background would yield two million gallons daily.

Treasure Hunting

by John L. Coontz

four men could stand with comfort. But more than this. Imagine, at the bottom of this black shaft a great mass of earth mowed out, a huge pit created, and created neither by hand or steel shovel. Imagine the filling up of this pit or hole again with gravel and stone from the earth, packed symmetrically and in accordance with certain engineering specifications.

"Modern deep-well digging accomplishes this—and more," says Paul Sweitzer, one of the world's foremost scientific deep-well diggers. Mr. Sweitzer has dug wells for the Federal government in Washington, giving to the great St. Elizabeth's Hospital in that city, millions of gallons daily of the purest water in the world; for the cities of Savannah, Georgia, Houston, Texas, Annapolis, Maryland, Jamaica, Long Island, St.



No, this is not an oil well, but—

a deep-well being "flushed" by forcing water into its depths by means of a hydraulic reamer fitted with jets. Right—A huge slab of clay that became wedged between the cutting blades of the reamer.

336 FT.
100 FT.

Left—Preparing the outer casing of a well. When in an upright position over the well hole these huge pipes will be welded together electrically so that they will form one continuous cylinder reaching to the well bottom. Below—Cores of various kinds of formations encountered during the digging of a deep-well. The numerals indicate depths at which formations were located.

Petersburg, Florida, and a host of others.

"The first step in deep-well digging today," said Mr. Sweitzer in a recent interview with the writer, "consists in obtaining from the United States Geological Survey a 'log' of the under-surface area surrounding the locality where the well is desired. With this 'log' in hand drilling operations commence.

"The first hole sunk," he continued, "is the 'pilot hole.' This hole is from two to eighteen inches in diameter and is designed to secure samples of water-bearing strata in the area. If water is found in sufficient quantity, real operations begin. The 'pilot' is drilled with a specially designed bit, one that my company has developed, capable of cutting through all underground material, such as rock, clay, sandstone."

Now that we have got a clear idea of how a deep-well is started let us take one of Mr. Sweitzer's latest accomplishments—that of the deep-well at St. Elizabeth's Hospital in Washington. This well was dug low down along the Anacostia River flats behind the high ground on which the hospital perches.

Propper rigging, like an oil derrick, is on the ground, sitting directly over the spot where the well is going down. The 'pilot hole' has already been sunk and tests show that water is to be had in sufficient quantity to warrant larger drilling operations.

"The first thing done after the 'pilot hole,' has been sunk," says Mr. Sweitzer, "is the reaming and casing of it. The size ranges all the way from 24 inches in diameter to 60 inches in diameter, according to the formation encountered. If sand is the formation the hole is made larger than otherwise.

"Reaming is accomplished with an instrument called a 'reamer.' This is a huge boring instrument composed of a heavy reaming shank and various cutting blades arranged in series of 4 to 8 blades, vertically. It is usually in two sections and the diameter of the blades is equal to that of the hole to be reamed.

"In operation this reamer loosens the earth, breaks it up and washes it out of the well. This last act is accomplished by a stream of water which flows down the center of the reamer shaft from the top to the bottom of the shank. Reaming out the hole and washing out the refuse are thus accomplished in one operation.

"Following the reaming of the well, it is cased off. This job consists of sinking huge sections of tubular steel, superimposed on each other and electrically welded together, end to end, down into the well. They are carried down by their own weight, spring steel guides along their sides keeping them centered in the well."

The well having been reamed and cased off the most delicate of all the operations in deep-well digging, and the most amazing of all engineering feats in deep-well construction, is proceeded with. This is the operation

[*Continued on page* 126]

Stainless Steel Trains And Short-Wave Radio Signaling Mark Railroad Progress

Flashing over the rails between New York, N. Y., and Philadelphia, Pa., this new streamlined train is the last word in passenger service and comfort. Except for wheels, axles, and truck assemblies, the entire train is constructed of stainless steel.

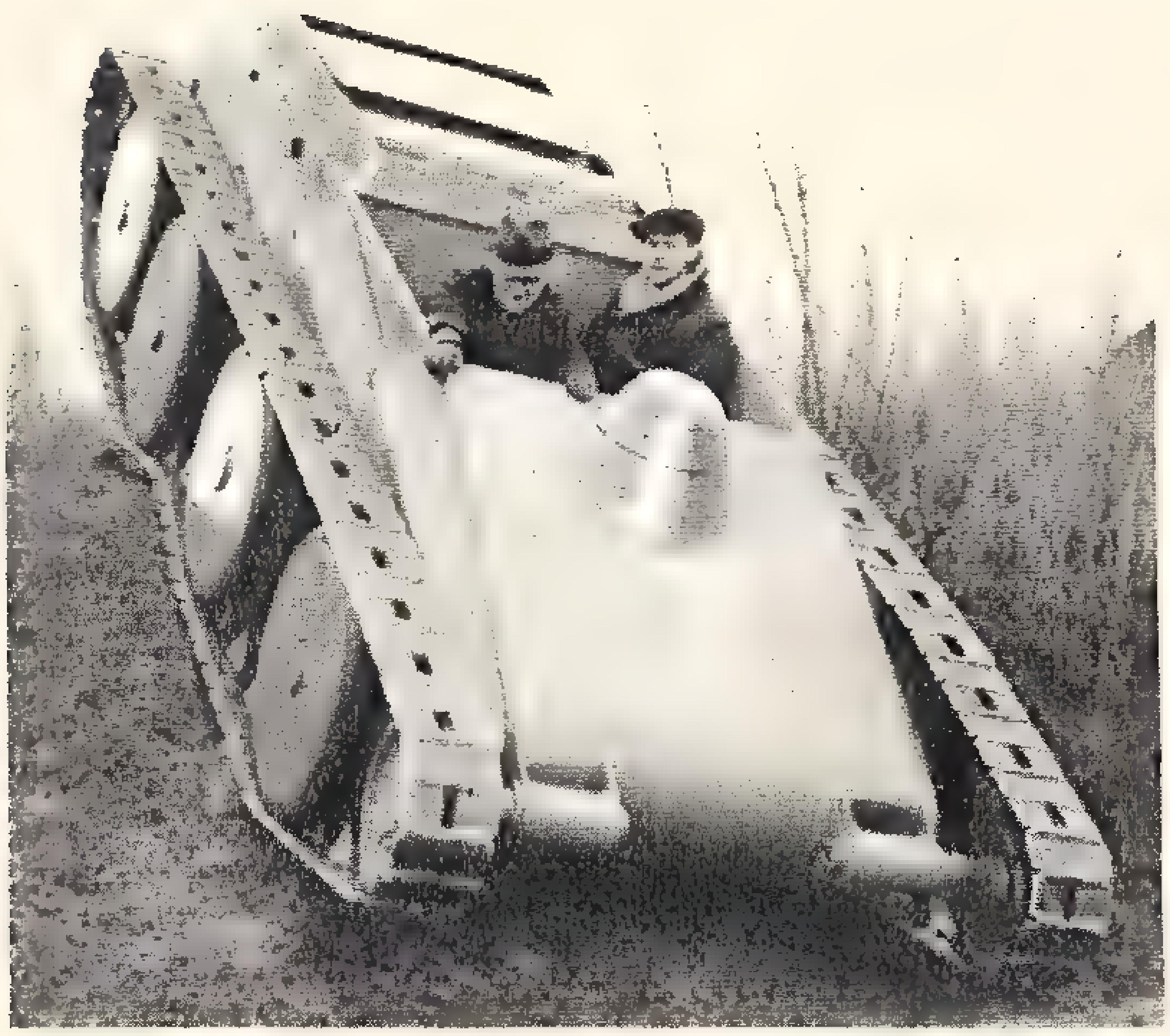
ATTAINING new heights in modern transportation science and artistic skill, a new stainless steel, streamlined train has been placed in service by the Reading Railway System, covering its route between New York, N. Y., and Philadelphia, Pa. The complete train consists of five cars and a locomotive representing an investment of about half a million dollars.

The passenger cars are said to be the last word in design, comfort, and beauty of interior decorations. The stainless steel construction gives each car a weight of only 97,000 pounds as compared with a weight of 170,000 pounds for conventional type passenger coaches. Each coach is equipped with 56 reclining seats, while the dining car is equipped to seat and feed 24 persons at a single sitting.

Marking another step in railroad modernization, the Pennsylvania Railroad has equipped some of its locomotives and cabooses with short-wave radio transmitters and receivers, providing a scientific method of replacing the old hand signals and lanterns formerly used for crew communication between the front and rear ends of long freight trains. Rigid-type aerials are mounted on the roofs of the cabooses and locomotive cabs.

Freight trains go modern, too. Shown above is a scene in a locomotive cab as a crew member talks over a short-wave radio system to fellow workers in a caboose at the end of a long freight train. Left—Rigid aerial mounted atop caboose roof.

Caterpillar-Type War Tank Attains 50 M.P.H. Speed



Weighing seven tons, this new type war tank not only climbs embankments with ease, but travels over level ground at a speed exceeding 50 m.p.h. Note how belt teeth engage wheels.

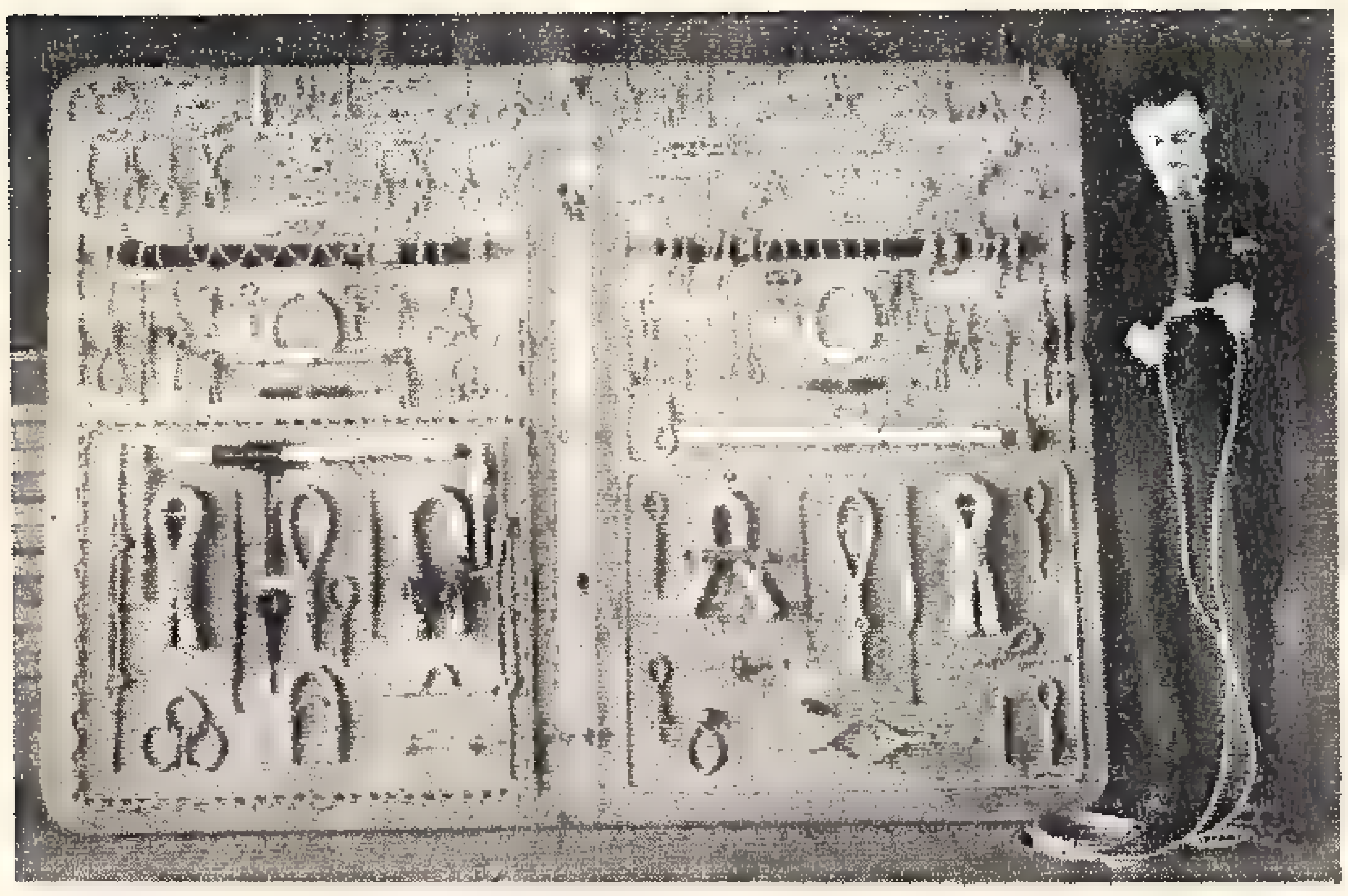
IN A TEST demonstration before United States Army observers, a new seven-ton war tank designed and built by J. Walter Christie, veteran automotive engineer, attained a speed of 50.14 m.p.h. over a measured course on the airport at Westfield, N. J. After the speed test, the tank was taken to another field where it demonstrated its ability to climb up and down 15-foot embankments.

The tank, a number of which have been contracted for by the British Army, according to reports, is equipped with four large and two small wheels on each side which engage a caterpillar-type belt to provide locomotion. The tank's armament consists of a small cannon and several machine guns.

Knotboard Shows 144 Types

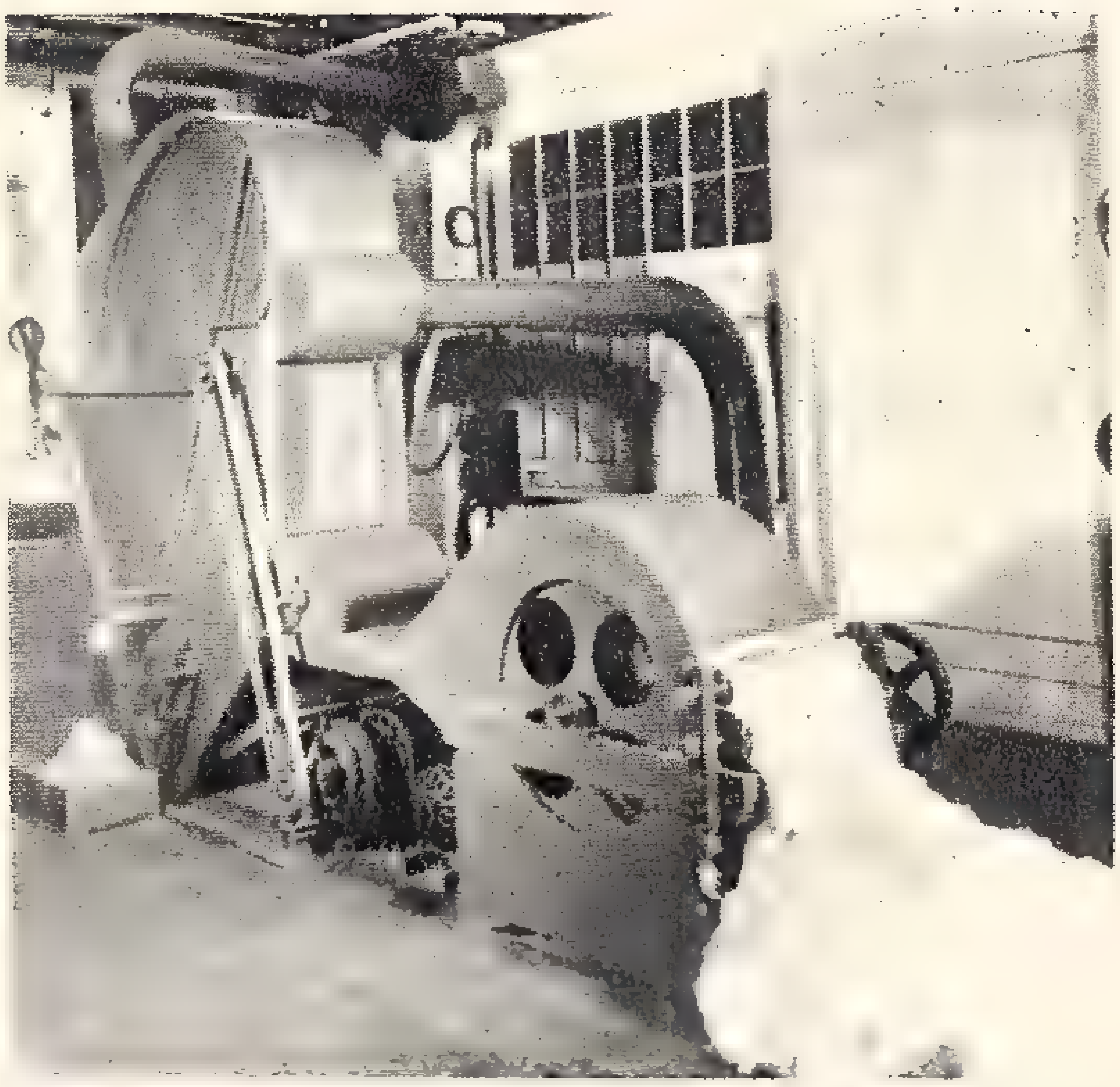
REQUIRING about one year of spare time effort to complete, a huge instructive knotboard developed by James W. Mackay, of Flint, Mich., features 144 knots, bends, hitches and splices. Mackay is a former U. S. Coast Guard boatswains mate and constructed the board at the request of a local American Legion Post, which presented the board to a Boy Scout troop.

The knotboard is six feet high and eight feet long and the knot collection is said to be the most complete of its kind. Many of the knots featured are of types no longer used by seamen and required quite some research before they could be authentically duplicated for mounting on the board.



Featuring 144 knots, bends, splices, etc., this huge knotboard was developed by James W. Mackay, former U.S. Coast Guard sailor, and presented to Scouts for instructive purposes.

Whirling Cotton Gin Devised



Employing centrifugal force, this cotton gin removes seeds from cotton without altering the original fiber length.

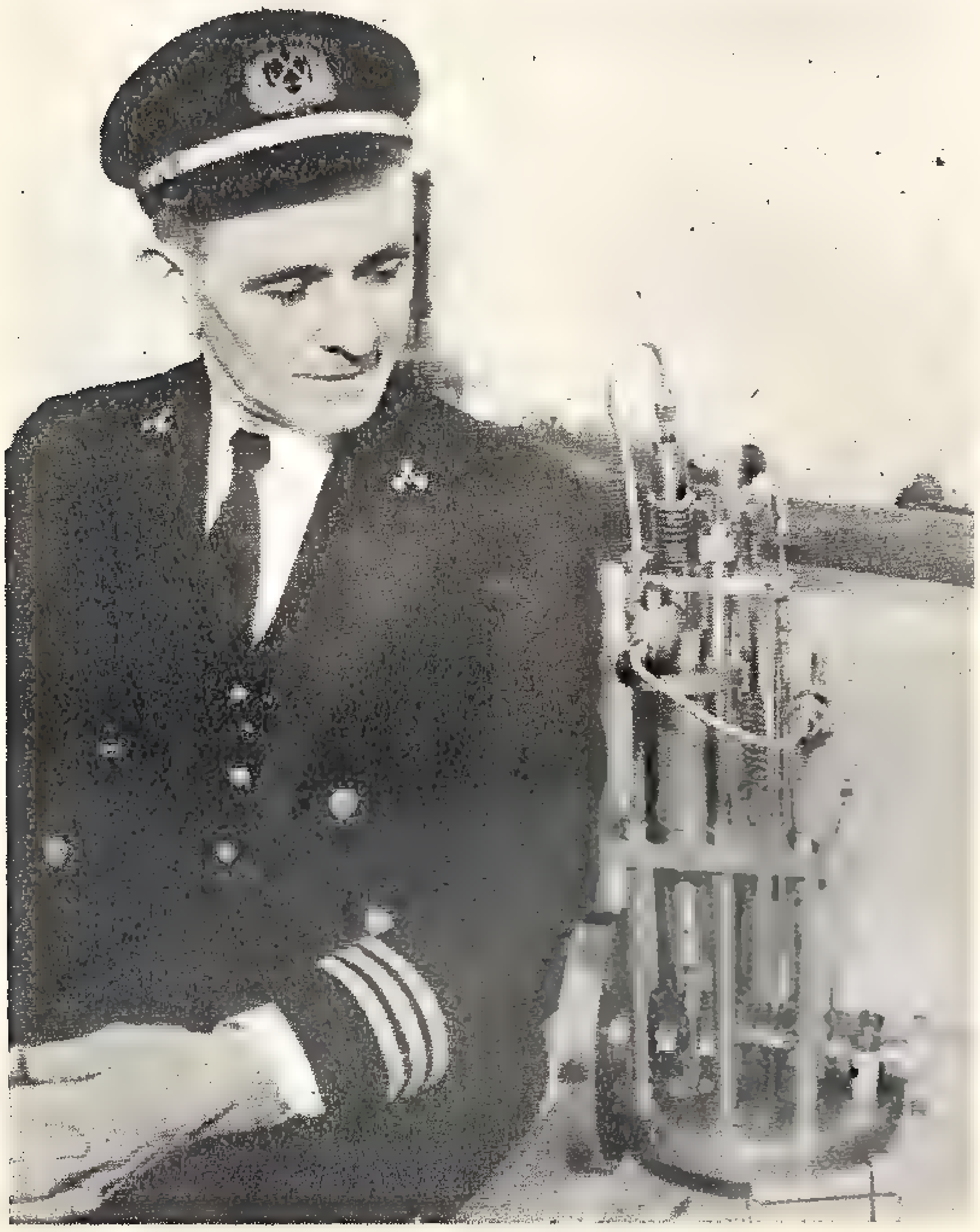
A NEWLY developed cotton gin whirls the cotton in a rapidly revolving drum to free it of seeds and impurities by centrifugal force instead of tearing the cotton to pieces with mechanical claws, as has been the usual ginning practice in the past. The machine, devised by Frank H. Watson, a planter in Jonesboro, Ark., also has the advantage of not altering the original fiber length as ordinary ginning methods do.

A list of addresses of manufacturers of items mentioned in MODERN MECHANIX will be sent to any reader upon receipt of a stamped, return envelope.

Army Air Corps Develops Dual-Purpose Balloon

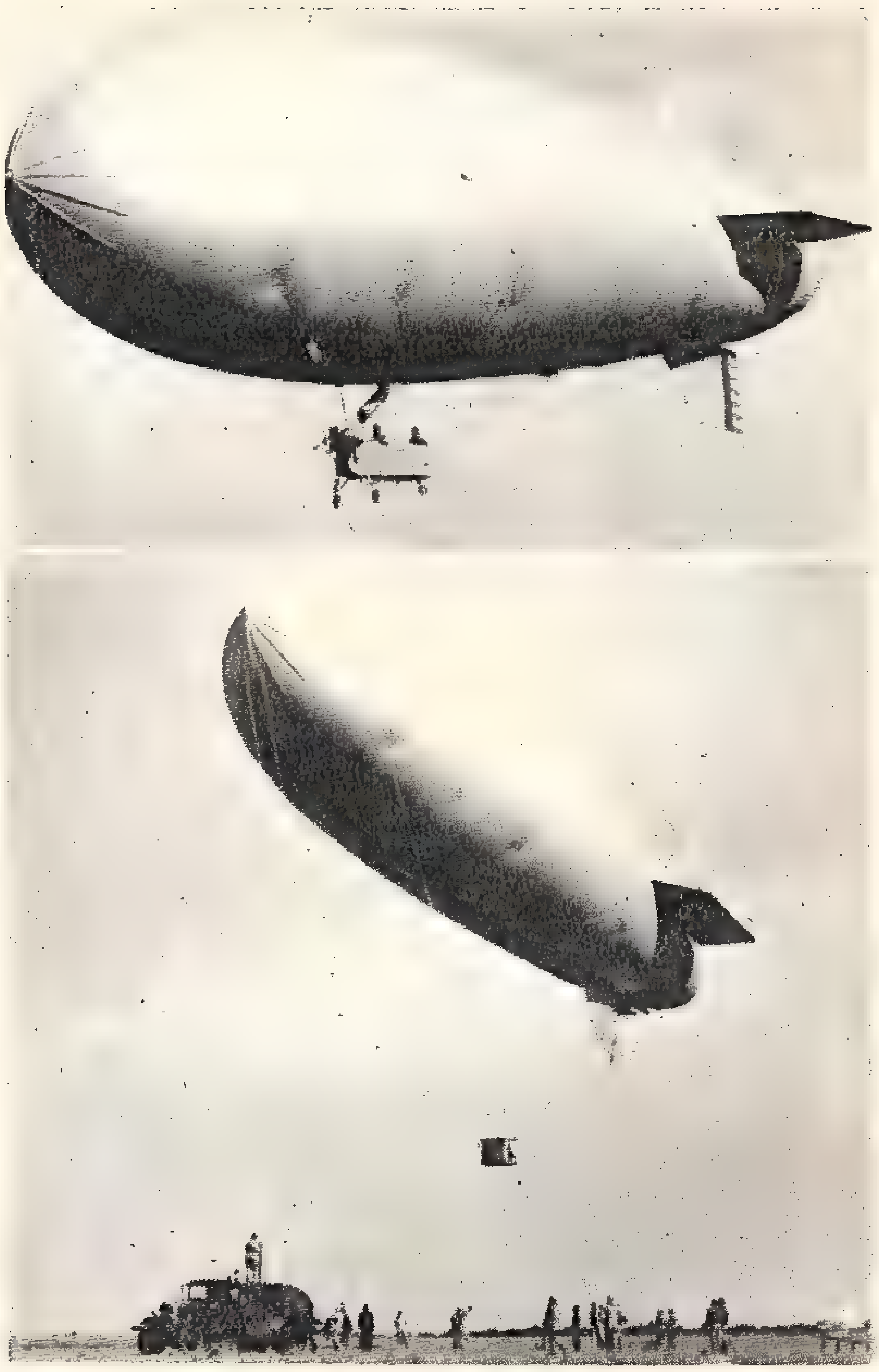
OFFICIALLY designated as the C-6, a new type of observation balloon has been developed by the U. S. Army Air Corps. The balloon is a dual-utility type and can be used as a "captive," being connected to a winch on the ground by means of a long cable, or as a "free" motorized balloon by replacing the usual observation basket with a small fuselage gondola, which is equipped with a 90-horsepower engine and propeller. The fuselage is fitted with a three-wheeled landing gear to facilitate landings.

Engineer Builds Tiny Diesel



W. H. Greenfield, a marine engineer, proudly displays the tiny Diesel engine he constructed. Motor develops ½-horsepower.

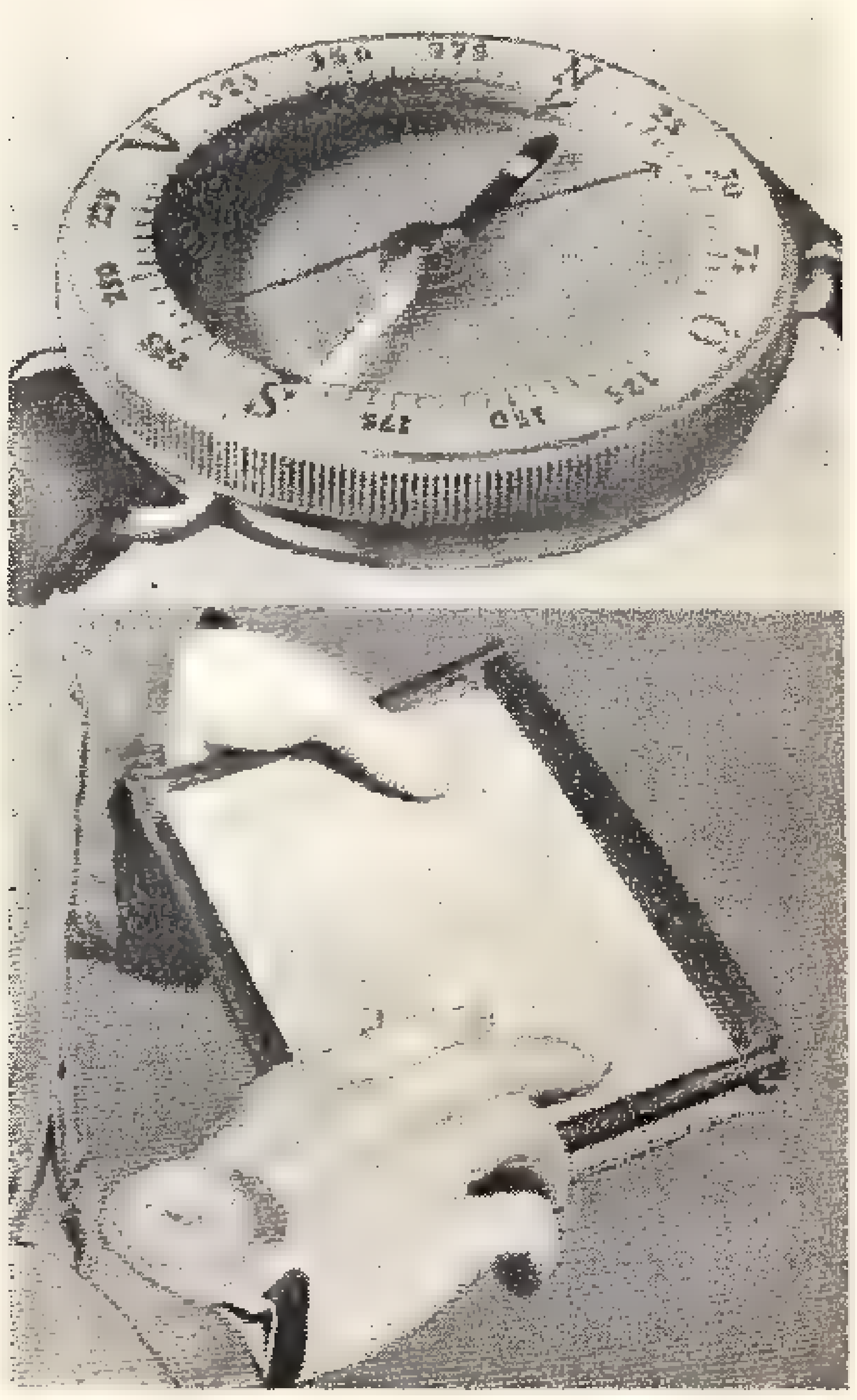
STANDING less than two feet high and weighing about 40 pounds, a tiny Diesel engine constructed by W. H. Greenfield, a marine engineer, is said to develop one-half horsepower at 3,000 revolutions per minute. The motor is believed to be the smallest working Diesel ever built, having a bore of one and one-tenth inches and a two-inch stroke. The novel motor also features a built-in supercharger.



The U. S. Army Air Corps' new C-6 observation balloon can be used as a captive type, connected to ground winches by cables (lower), or as a free type (top) by exchanging regular observers' basket for a small gondola fitted with an engine.

Liquid-Type Wrist Compass

A COMPACT liquid-filled wrist compass devised by a Swedish engineer is said to be more accurate than the ordinary air compasses generally used by campers and outdoor men, the liquid serving to effectively minimize the oscillations of the magnetic needle. The glass used in the compass is shatter-proof and the case is leak-proof, eliminating the necessity of refilling. Photos at right show the compass close up and in use on the wrist of a hiker.



Miniature Village Thrills Children

The miniature village of Bekonscot features a waterfront, complete with quays, cranes and model ships, which are the delight of youthful visitors (above). The railway system (right) is another attraction.

The tiny village's airport (left) and country club croquet lawn (right).

DESCRIBED as a veritable children's paradise, a miniature village constructed by G. S. Grey, of Beaconsfield, England, is complete in every respect, having its own airport, wharves, model liners, tugs, barges, trains, etc., as well as a country club with tennis courts, a golf course and croquet lawns. Known as Bekonscot, the novel village is designed on a scale of one inch to a foot and covers 1,100 square yards.

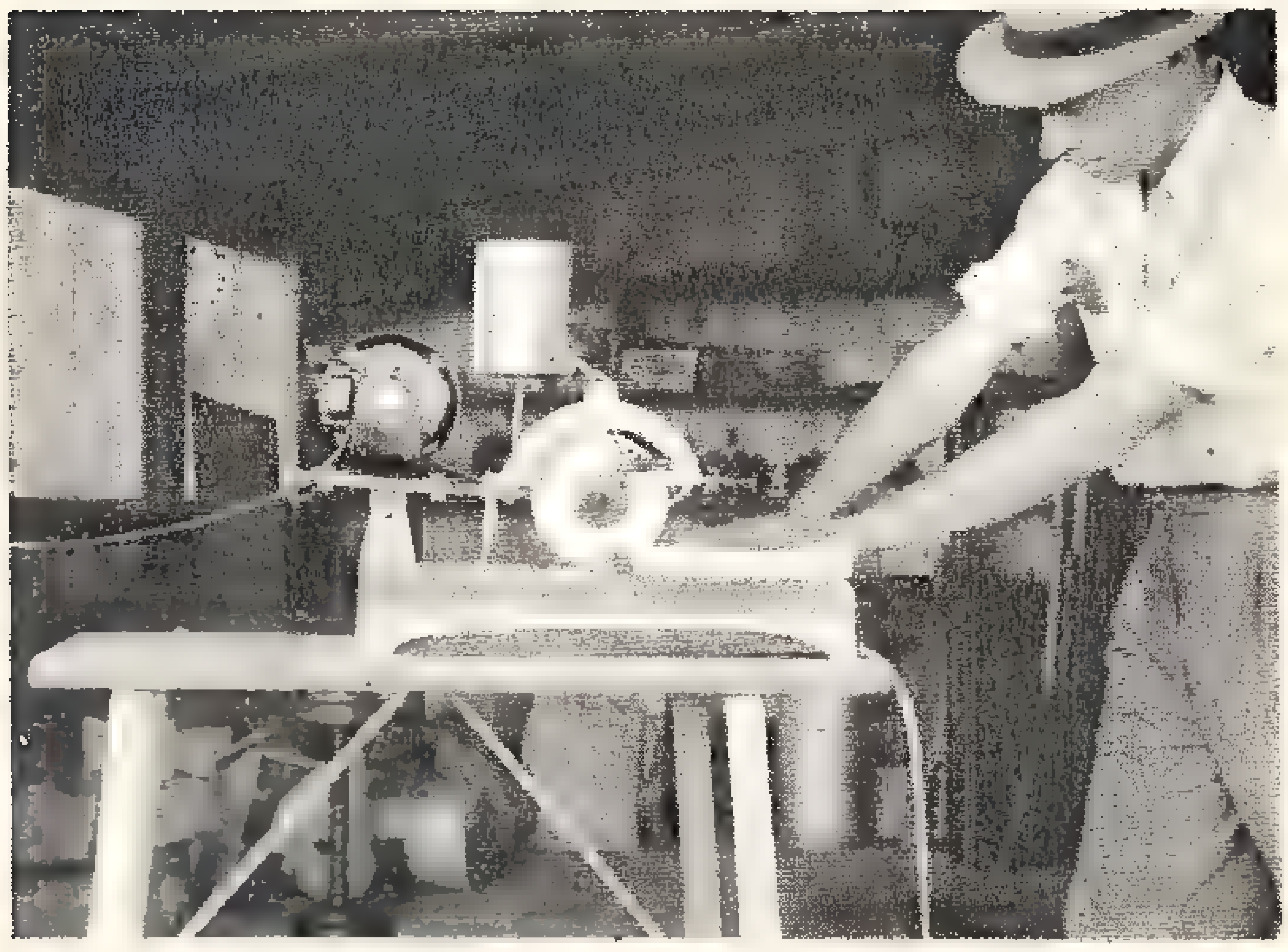
The houses and shops in the diminutive village are constructed of actual building materials—tiny bricks, tiles, plaster, timber, etc., and the roads are made of asphalt, cobblestones and wood blocks. The village's electric railway system has a main terminus and five stations, while the "steamship" lines have individual docks. Life-like wooden figures of men and women comprise the population of the novel village.

Museum Technician Builds Planetarium Projector

COSTING $12,000 for materials, a planetarium projector constructed by Frank D. Korkosz, a technician at the Springfield, Ohio, Museum of Natural History, is said to perform as efficiently as similar projectors imported at a cost of $100,000. Korkosz, son of a Polish immigrant coal miner, has attracted nation-wide attention with his home-built projector equipment.

The projector is comprised of numerous electrically operated lanterns, each of which throws a picture of a portion of the sky onto an overhead dome. The pictures, all matching together, without overlapping, produce a panoramic replica of brilliant stars.

"Saw" Has Toothless Blade

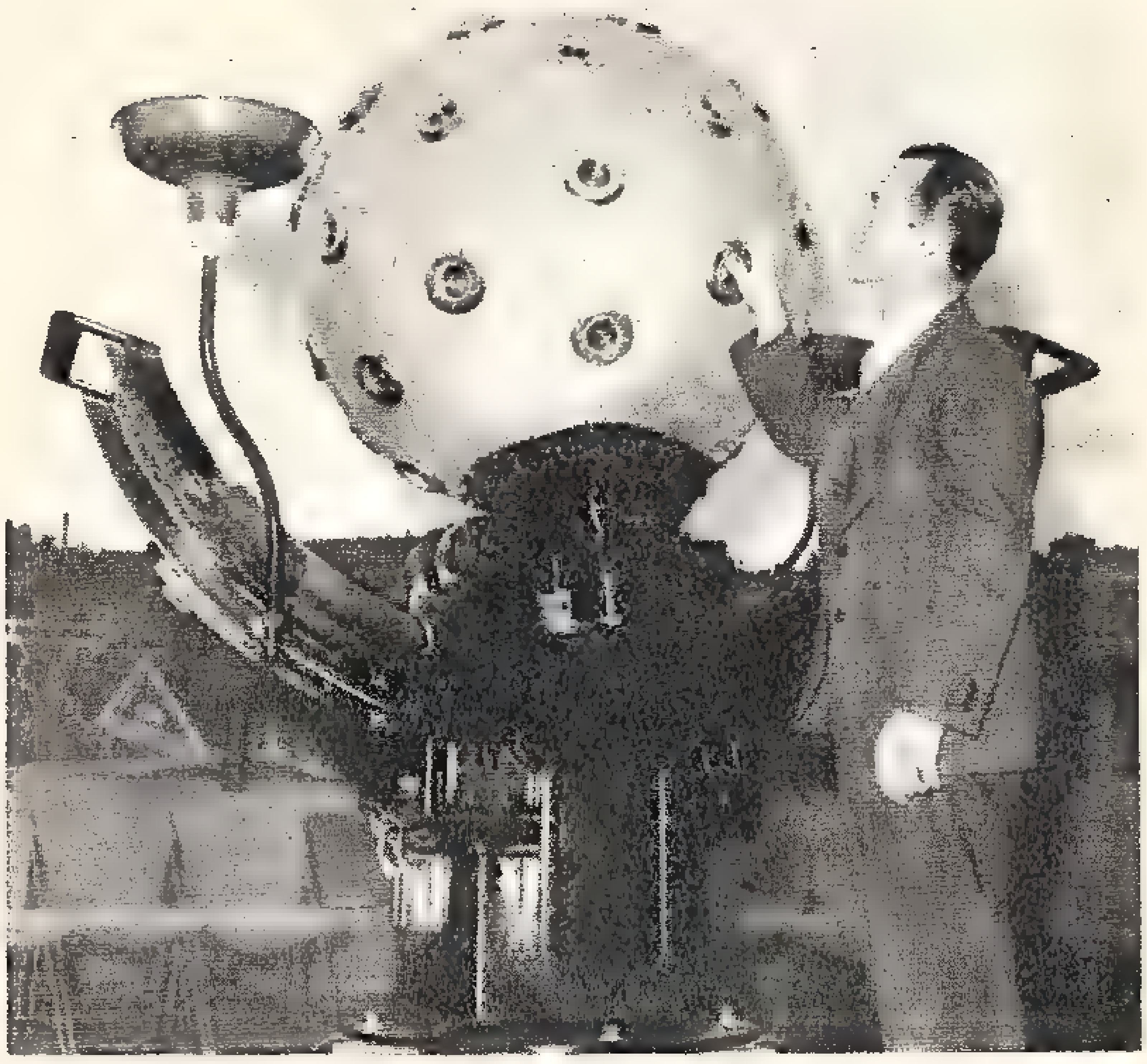


Featuring a diamond-impregnated blade, this machine is capable of cutting tile, stone, glass, etc., yet the operator's fingers can be placed directly against blade without injury.

A NEW machine "saw" developed by a California manufacturer can be used to cut tile, glass, stone, non-laminated plastics, porcelains and vitrified products, yet it's cutting blade has no projecting teeth and cannot break or fly to pieces. Despite the machine's unusual cutting ability, the operator's finger can be placed directly against the cutting edge without injury.

The "secret" of the new cutting machine is a circular diamond-impregnated metal blade. The unexcelled cutting quality of the diamonds enables the blade to cut the most brittle materials with unusual cleanness. Even delicate porcelains can be cut without marring the glaze, it is claimed.

If you are interested in any of the items mentioned in this issue, send a stamped, return envelope for the address of the manufacturer.



Frank D. Korkosz, a museum technician, demonstrates the planetarium projector he constructed at a cost of $12,000. The apparatus projects pictures of stars onto a dome "sky."

World's Biggest Model Plane

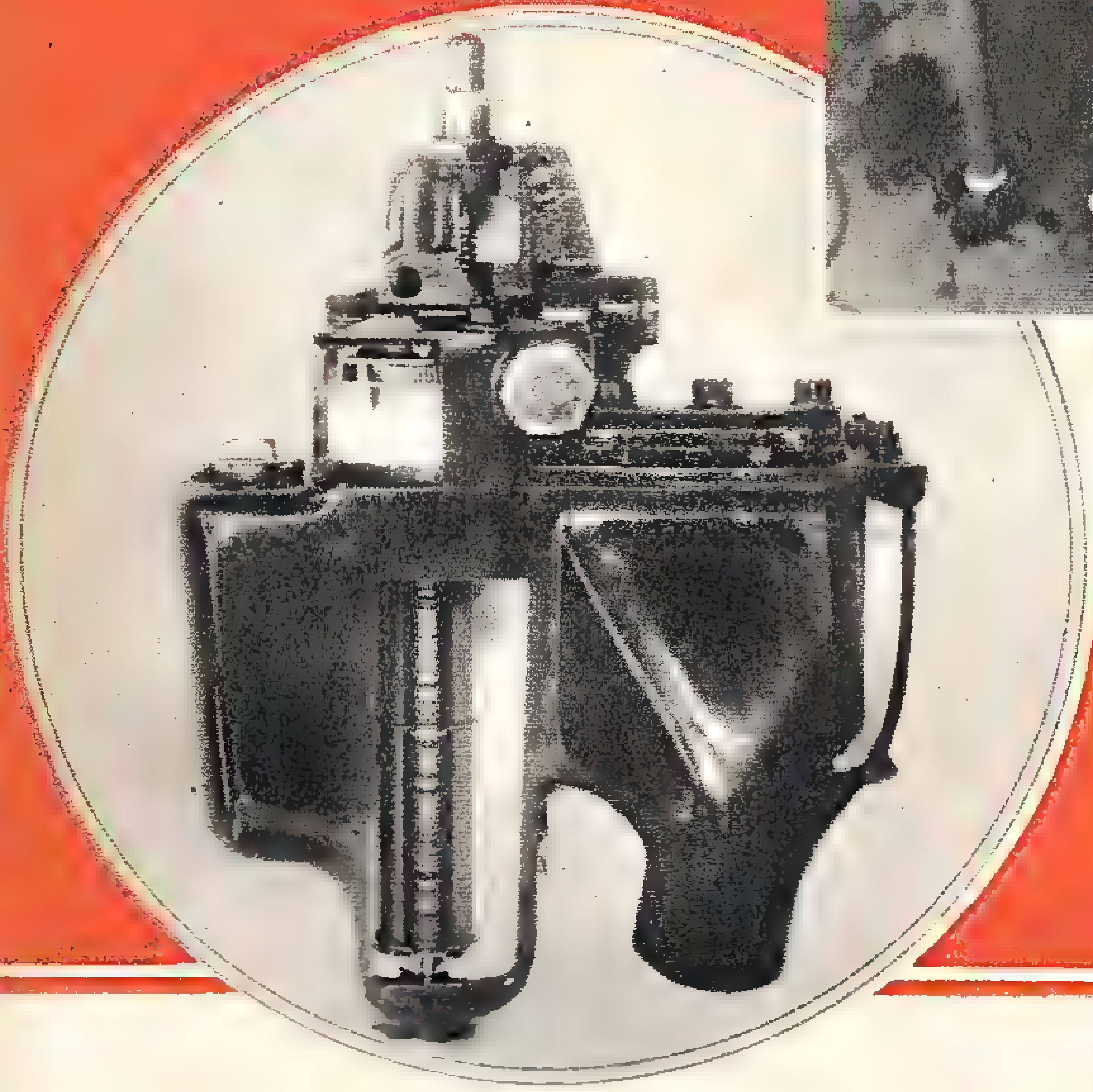
CLAIMED to be the largest model airplane in the world, a scale model of the flying boat *Canopus* was recently placed on display in a London, England, department store. The model has a wingspan of 15 feet and weighs about 23 pounds.

The unusually large model plane is equipped with four miniature gasoline engines and after it has served its purpose as a display object, it is planned to test its flying qualities. The prototype *Canopus* flying boat is one of the huge trans-oceanic air liners now being operated by Imperial Airways between England and America.

Equipped with four miniature gasoline engines, this replica of the Imperial Airways' flying boat *Canopus* is claimed to be the largest airplane model in the world. Wingspan is 15 feet.

The installation of self-cleaning oil filters, such as the type shown below, enables fleet owners to save hundreds of dollars annually in reduced oil bills alone, to say nothing of the savings in engine wear and tear. Some filters feature renewable clarifier cartridges which keep the oil so clean that many operators instruct their drivers to change oil only every 5,000 to 8,000 miles.

Have your car tested regularly with modern equipment (above) if you want to keep repair bills down and efficiency up at economical operating levels.



FOLLOW

HOW would you like to cut the cost of operating your car from 25 to 50 per cent? Or do you think that is an idle dream?

Believe it or not, this pleasant reverie can come true, if you will merely put your motoring on a business-like basis. It is a matter of adopting the sort of management that is helping large companies save sizeable sums in the operation of their traveling employees' cars, trucks, buses etc.

Follow the fleet owner, if you want to enjoy more miles to the dollar. His rules are fairly simple, yet they produce results that seem incredible. The fleet owner does not think there is anything exceptional about the lowered cost of operating his cars. He expects it. The savings are yours, too, if you will handle the subject as you would your own business.

By rotating tires (switching from one side of the car to the other, and shifting the rears to the front in a counter-clockwise direction) it is possible to double their life. One firm found that by insisting that their men rotate tires every 6,000 miles, working in the spare, mileage jumped from the usual 15,000 to 30,000 or more. Tests showed that, although in some cases it was better to switch tires in the way I suggest, it was the mere changing of the tires that produced the real savings. A tire that stays in one position too long may be punished for any irregularity of the brakes or misalignment of the wheel on which it is mounted.

Since bringing all of its cars under one management the motor vehicle department of an eastern state has raised gas mileage four miles per gallon in individual cases. Tests show that most carburetors are adjusted too rich, providing extra acceleration which drivers do not actually need. Operators are being educated to realize that in emergencies better acceleration can be obtained by dropping into the modern fast second gear. In many cases it is found that the automatic choke is not properly adjusted, or that it isn't

Applying the suggestions made in this article may reduce your auto operating costs as much as 50%.

Bus line operators regularly check their vehicles for wheel misalignment (right) because they know it causes premature tire wear and faulty braking.

THE FLEET

by
Frederick C.
Russell

working properly. Drivers also are cautioned against allowing the engine to idle for warming up purposes where an automatic choke is used. Under such conditions an engine merely loads up, not only wasting gas but diluting the engine oil as well.

Since 1928 the operating cost per mile for several hundred cars operated by an insurance company has dropped from 8.6 cents per mile to 3.4. This has been accomplished despite the fact that the company uses a large percentage of cars which do not provide high gas mileage. The management was unable to lower the cost materially until it discovered that there is a very definite period beyond which it is more economical to trade in for a new car. This point is found to be just before the owner is faced with the necessity of having major repairs performed on the car and can

Unbalanced wheels may easily cause rapid tire-tread wear and front wheel "shimmy," so thrifty drivers check them regularly.

be recognized by a marked drop in the car's operating efficiency.

Three years ago the management officials of a well known firm were criticized for trading in so frequently. The officials began to wonder if it wouldn't be better to make major repairs, hoping that the cars would take a new lease on life and be as good as new. The cost per mile immediately started to climb. To check this rise it was necessary to trade in all the cars.

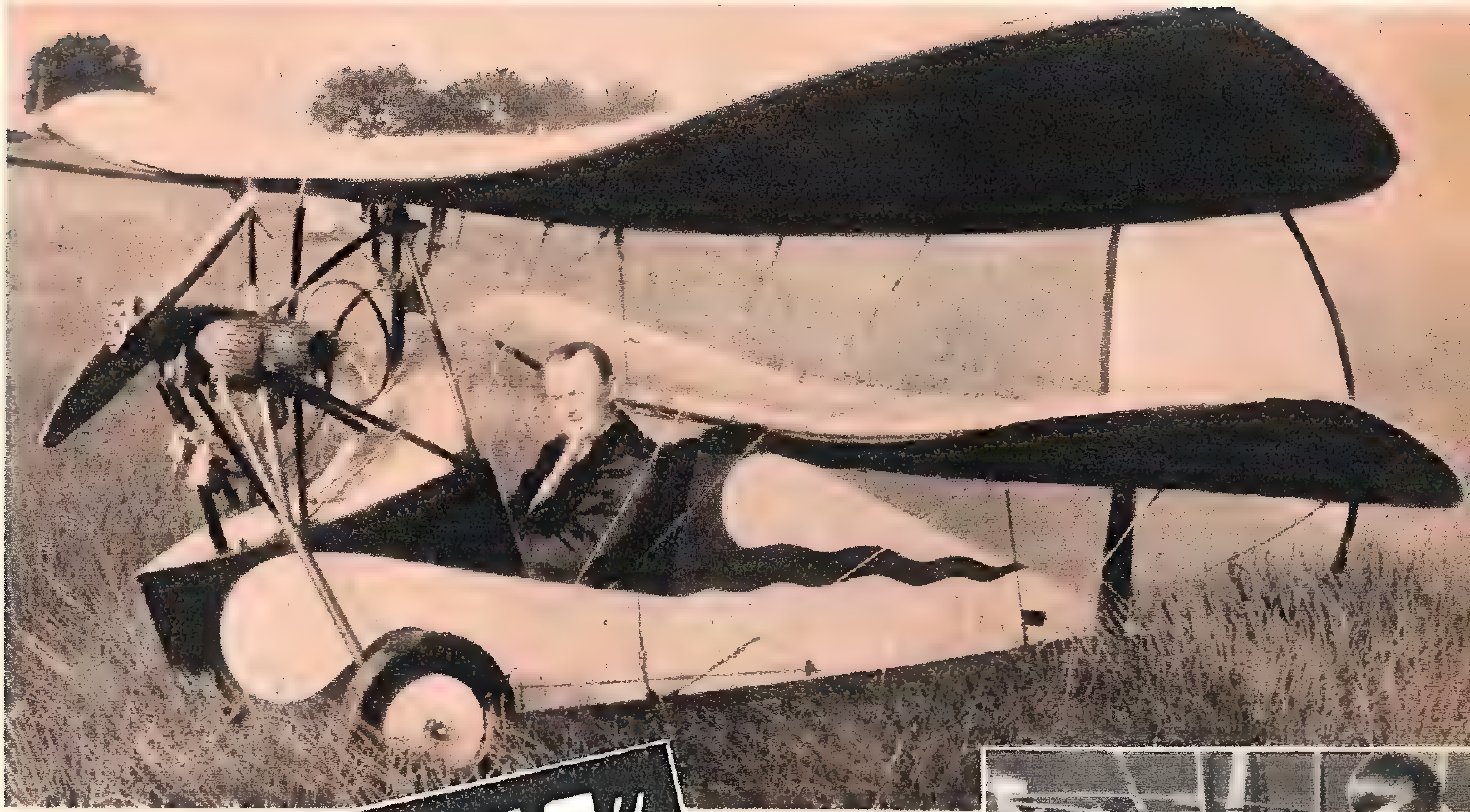
Fleet operators are saving dollars in a variety of new ways. If cars come through regularly equipped with four-ply tires they pay a small difference and specify that six-ply tires be installed at the factory. They are equipping engines with clarifiers, not merely oil filters. These clarifiers keep the oil clean and free of acids. Oil changes, according to one company's instructions to employees, are to be made every 8,000 miles in summer, every 5,000 miles in winter. It is believed that the oil could be used with safety over even longer periods. Some of the savings in oil are offset by the cost of replacing the clarifier cartridges, but it is found that filtration and clarification of the oil more than pay for themselves in terms of savings in engine wear and tear.

Inspection plays an important role in fleet operation. One company requires that the service stations which benefit by its business must make confidential reports on the cars to the home office. This must be done once a month. The report tells the fleet manager such details as the inflation pressure and condition of each tire. All of the usual things considered in a normal check-up are reported, but in addition the service station must advise if the clutch pedal clearance was found to be correct, and whether the quality of oil in the crankcase was up to standard. It is apparent to anyone who studies the marked savings in the operation of fleets that the average car owner pays dearly for the privilege of being his own boss.

One reason so many owners pay so much

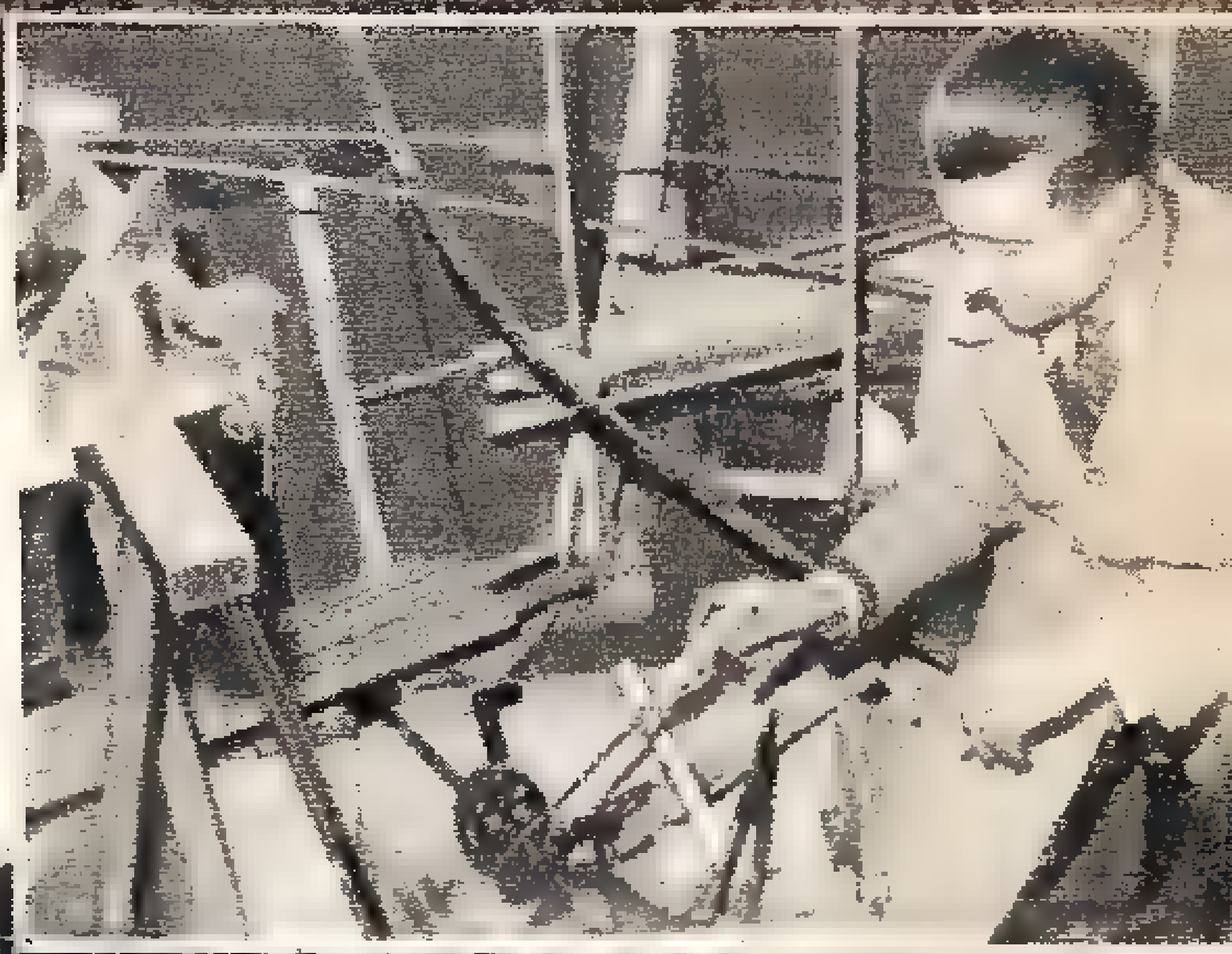
[*Continued on page* 118]

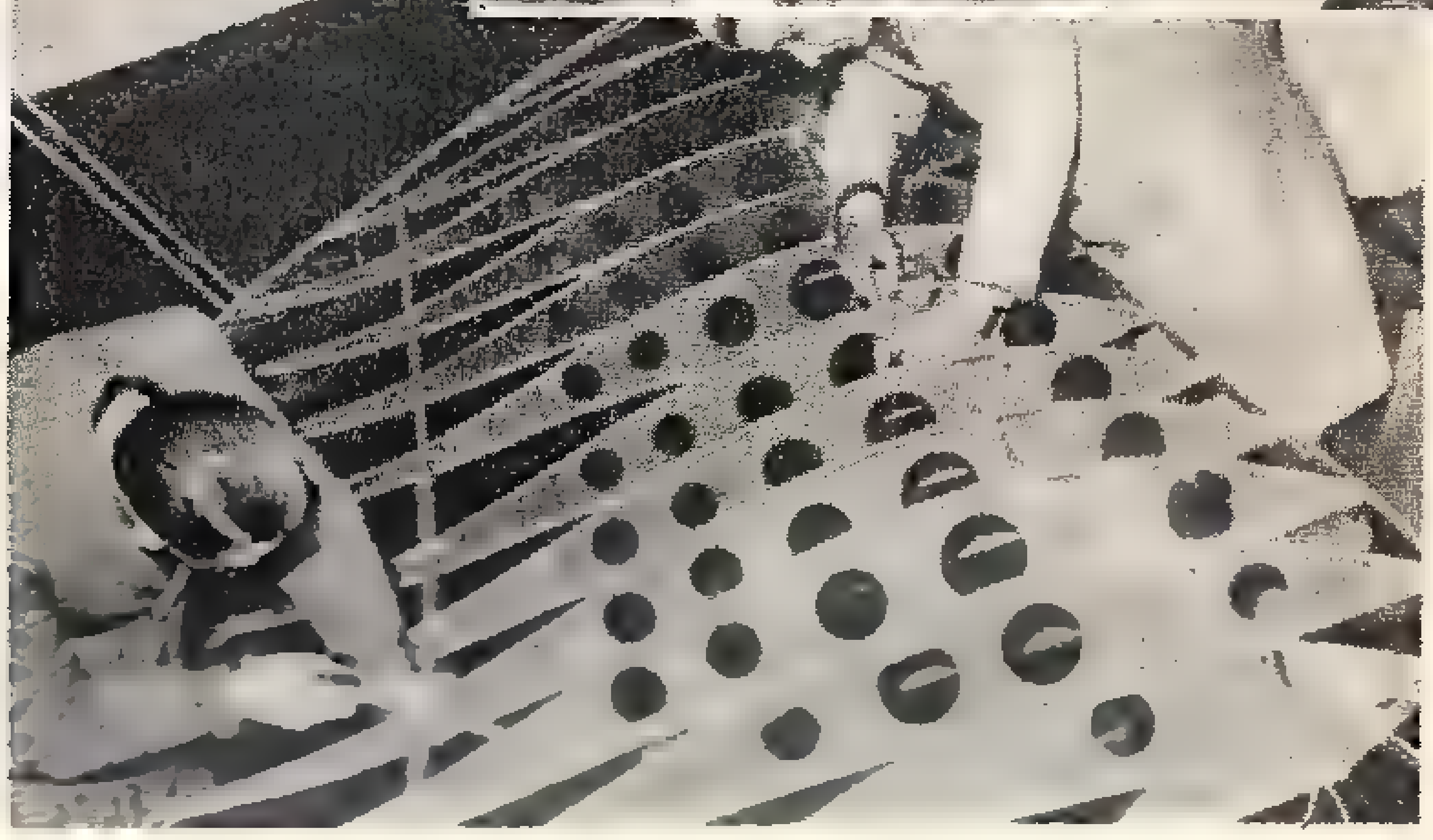
Proper maintenance not only lowers operating costs, but enables bus line operators to keep their equipment at the degree of efficiency required in order to maintain schedules. Inspectors (right) supervise all servicing to assure better work and lessen the chances of an oversight. Above—Checking an oil clarifier after a 5,000 mile run without changing the oil. These devices can be installed on any car and pay for themselves quickly in savings on lubrication bills.



"SKY FLEAS" Popularize Sport Flying IN FRANCE

Above — Henri Mignet, designer-builder of the first "Sky Flea," prepares for a trial flight in France. Note the novel wing arrangement.





Only a few simple hand tools are needed to build a "Sky Flea" (center). The light-weight wings feature metal ribs and wooden spars and can be assembled in fast time (above).

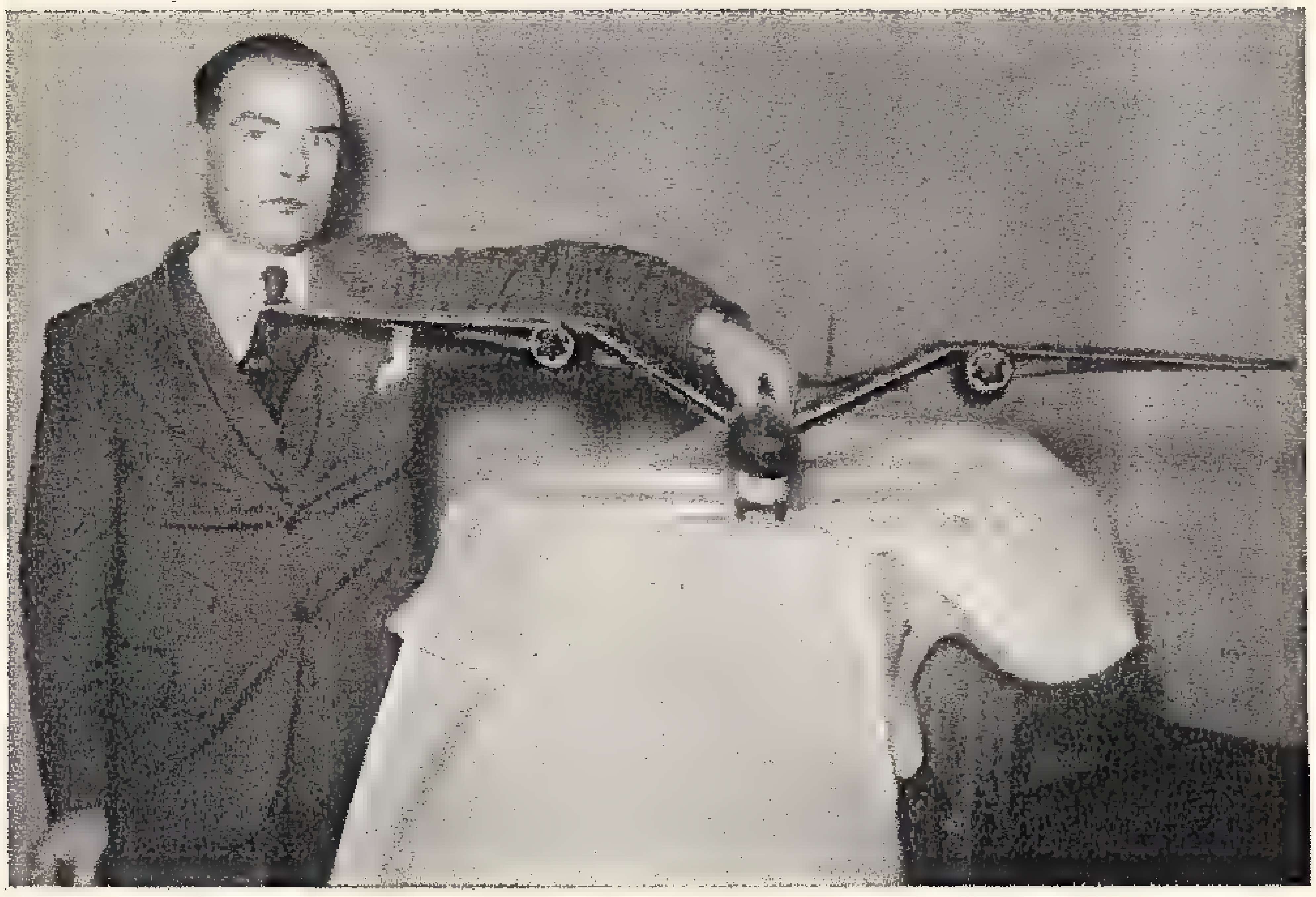
SEVERAL years ago a Parisian inventor. Henri Mignet, excited the amateur aviation world by designing and building a tiny plane which was unusually novel in appearance and radical in the method by which it was controlled. The Pou du Ciel or "Sky Flea," as the plane was known, required little skill to build and, since Mignet flew his first "brainchild," more than 1,000 have been constructed by French amateurs.

Another reason for the popularity of the "Sky Flea" is that, equipped with a ten to seventeen horsepower engine and featuring a fuselage consisting of a spruce framework covered with plywood, the plane costs less than $500 to build. The wings are very easy to construct, being made of metal ribs, wood spars and fabric. Simple tools such as saws, hammers, pliers and hand-drills are all the tools required to build the entire plane.

The "Sky Flea" replaces the aileron and elevator controls found on conventional aircraft with a large main wing, which is pivoted on a tubular metal support in front of the pilot's cockpit in such a manner that the leading edge of the wing can be moved up or down and tilted laterally to control the climb and descent or banking of the plane, respectively. A fixed wing is mounted close to and slightly below the main wing.

Mignet published a book telling how to construct a "Sky Flea." It enjoyed a large sale in France as well as in many other European countries although the flying of "Fleas" has been banned by England.

New English Airplane Will Feature Bat-Like Wing

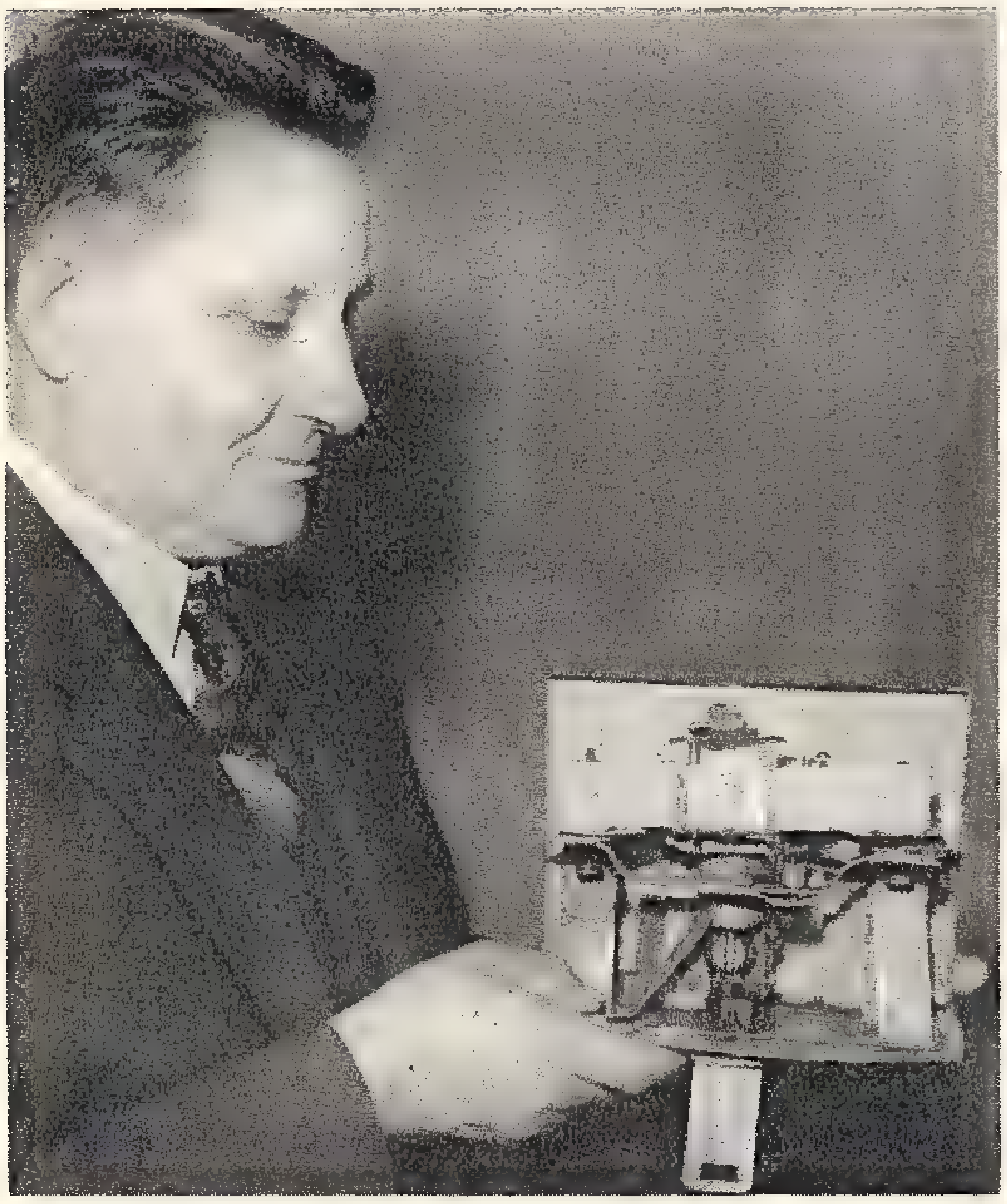


Resembling a bat in appearance, this model was constructed by P. N. Willoughby to demonstrate his design for a new plane now being built in England. Note twin motor arrangement.

A NEW type aircraft of novel design, featuring a wing arrangement that makes it look like a bat in flight, is under construction in Oxfordshire, England. P. N. Willoughby, designer of the plane, has constructed a model of the plane for demonstration purposes. The model indicates that the full-size plane will be a high-wing monoplane with accommodations for a pilot and passenger in a nacelle-type fuselage. Two American engines of 125-horsepower each will be used to power the finished aircraft.

Device Records Car's Speed

A SIMPLIFIED speed register for automobiles, which is said to provide an accurate record of a car's speed for each quarter mile of travel, has been invented by Matt Niemi, of San Francisco, Calif. The device features a paper roll on which barometer-like markings are perforated while the auto is in motion. The paper roll is replaceable.



This automobile speed register device features a paper roll on which a car's speed is recorded by scale perforations.

Builds Giant Television Tube

Allen B. DuMont examines the giant cathode-ray television tube he has developed. Tube has a diameter of 13½ inches.

DESCRIBED as the "Big Bertha" of cathode ray tubes, a new television tube developed by Allen B. DuMont, of Montclair, N. J., has a diameter of 13½ inches. The largest tubes heretofore available for oscillograph work have been of a 9-inch diameter.

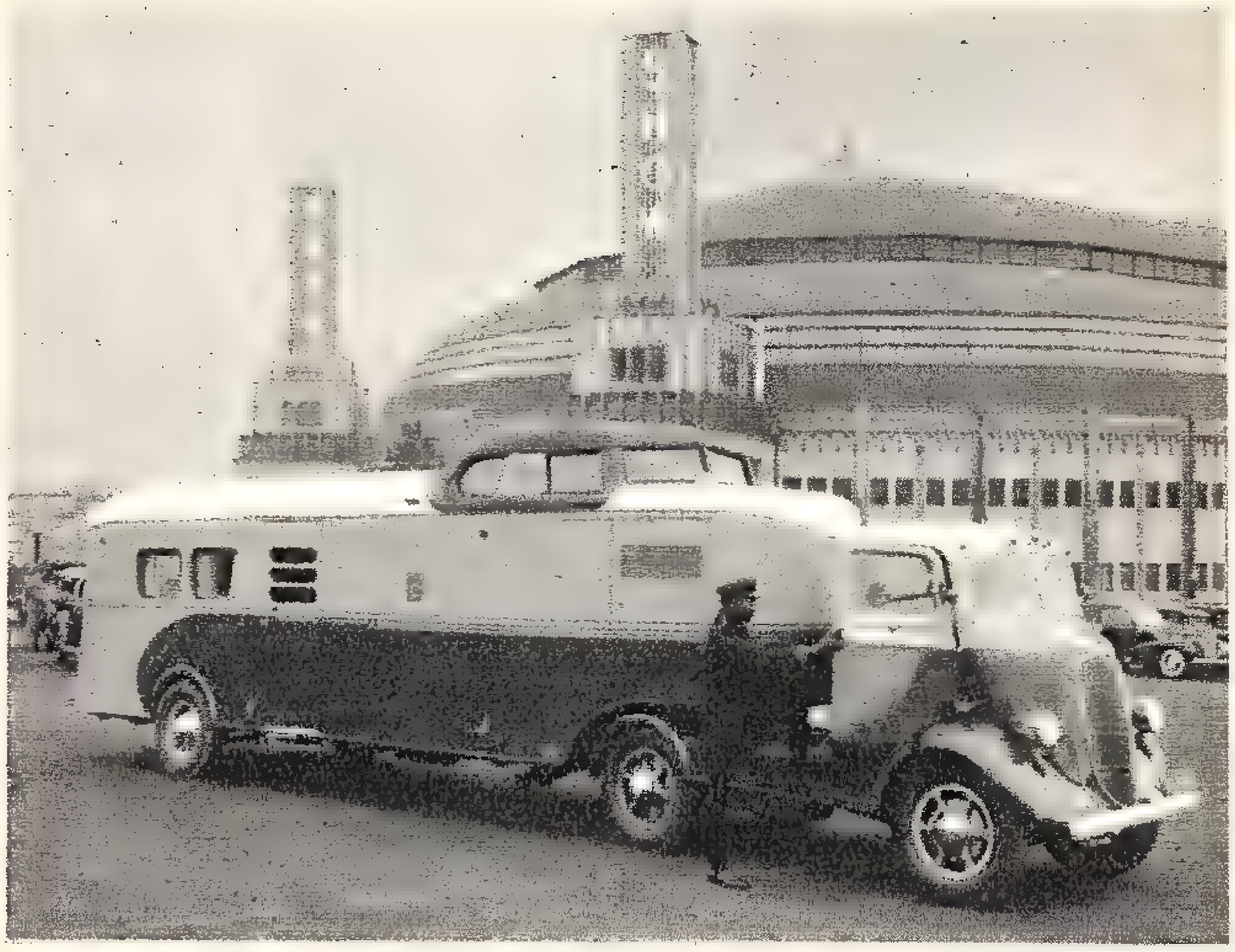
The new television tube is distinguished by its rounded sides, which provide the necessary added strength to withstand the atmospheric pressure on the highly evacuated glass bulb of the tube.

World's Largest Trailer Built On Tractor Chassis

WHEN executives of a large midwest electrical appliance company travel, they use what is believed to be the largest trailer of its type in the world. Called "The Flagship," it is probably the most completely equipped trailer in existence.

It is equipped with special Pullman berths, air conditioned by a one-ton air conditioner, heated by a hot-water system, lighted by a 2,000-watt plant, and has two radios.

A special feature is the cockpit or observation deck which seats four persons and is used as sleeping quarters at night by the "crew." This trailer has a permanent personnel including a cook and chauffeur. The galley is modern in every detail, having mechanical refrigeration, a gas stove, hot and cold running water, and all the essentials for serving twelve persons.



Note the special observation tower in which four persons can ride. It serves as sleeping quarters during the night for the crew. The trailer itself measures twenty-eight feet, while the trailer and tractor together are thirty-six feet long.

Electricity Frisks Mattress

Hidden metal objects in a mattress can be found quickly and easily with this device. Once a day every mattress in the penitentiary is subjected to its scrutinizing inspection.

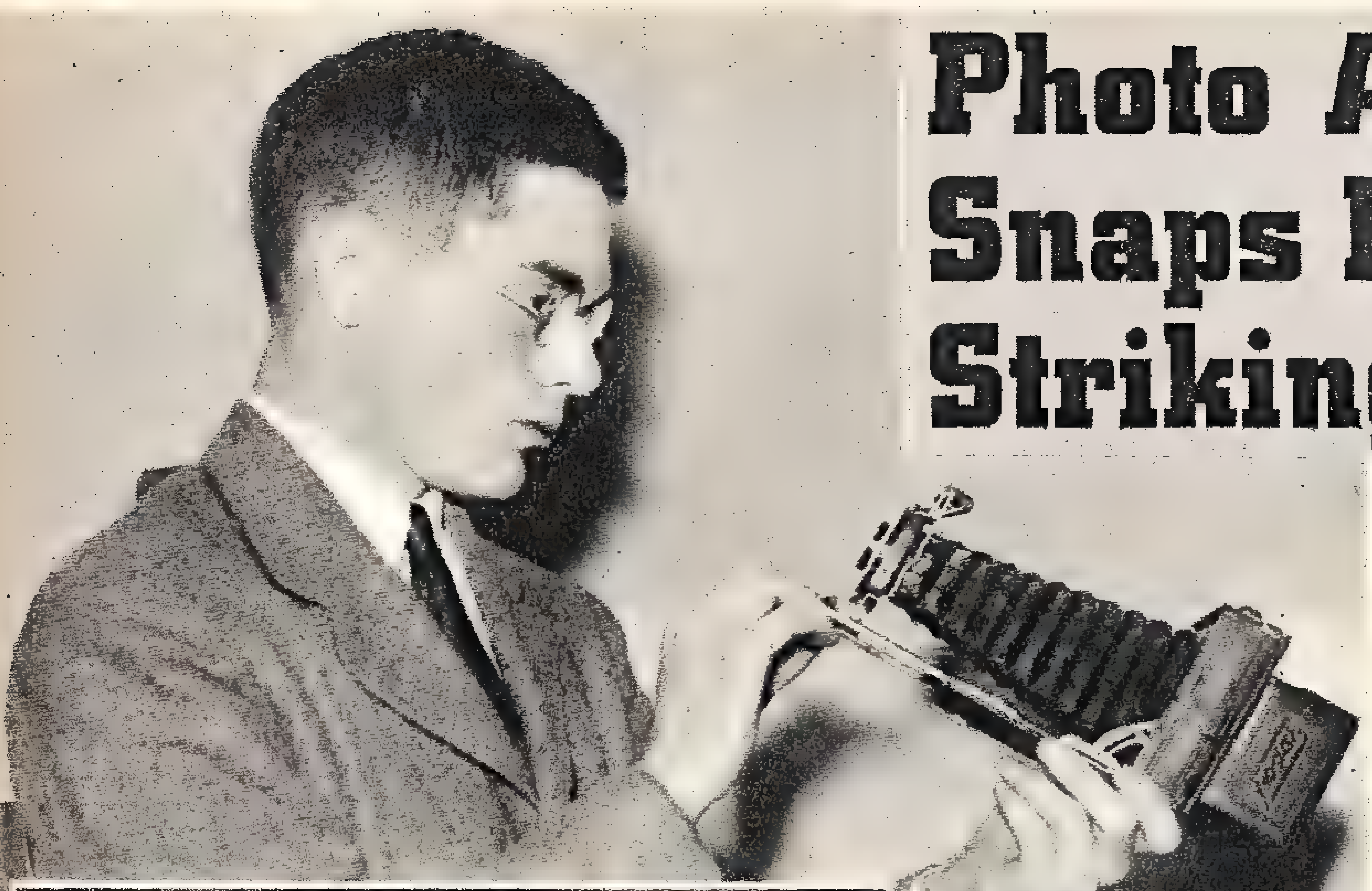
IF PRISONERS in the Joliet and Stateville, Ill., penitentiaries should hide pistols, knives or saws in their mattresses, this machine will detect them. It is wheeled around the prison, and every mattress is subjected to its scrutiny once a day.

Skipper Inspects Ship's Model

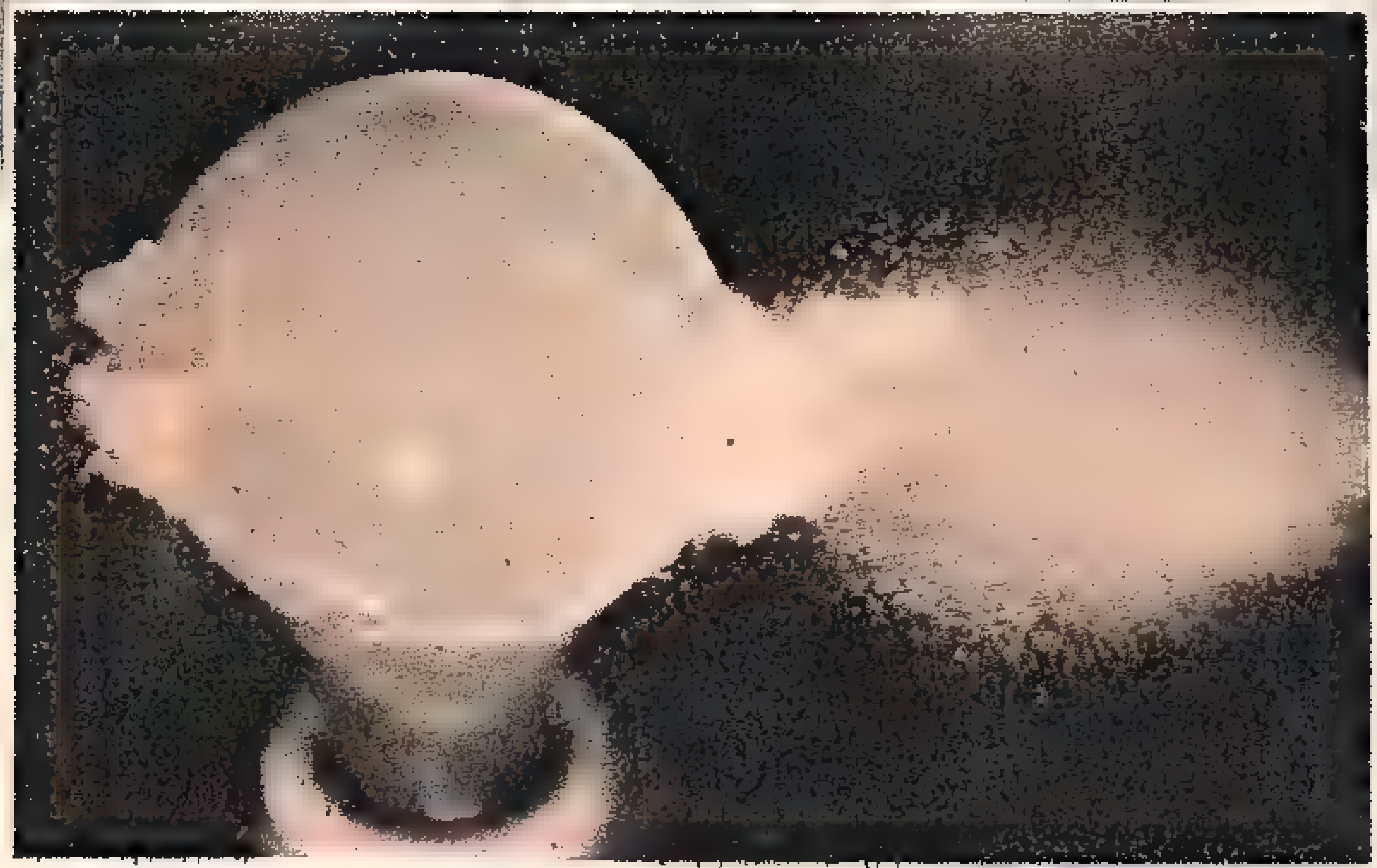
When the *Pennsylvania* was in Havana, Cuba, harbor, this 5-foot model was brought aboard by a Western Union messenger, Armando Martinez Petit, who offered to sell it for $150.

CAPTAIN HAROLD L. WINSLOW, skipper of the Panama Pacific Liner *Pennsylvania,* is shown on the deck of his ship as it reached New York with a five foot model of the liner.

Photo Amateur Snaps BULLET Striking LAMP



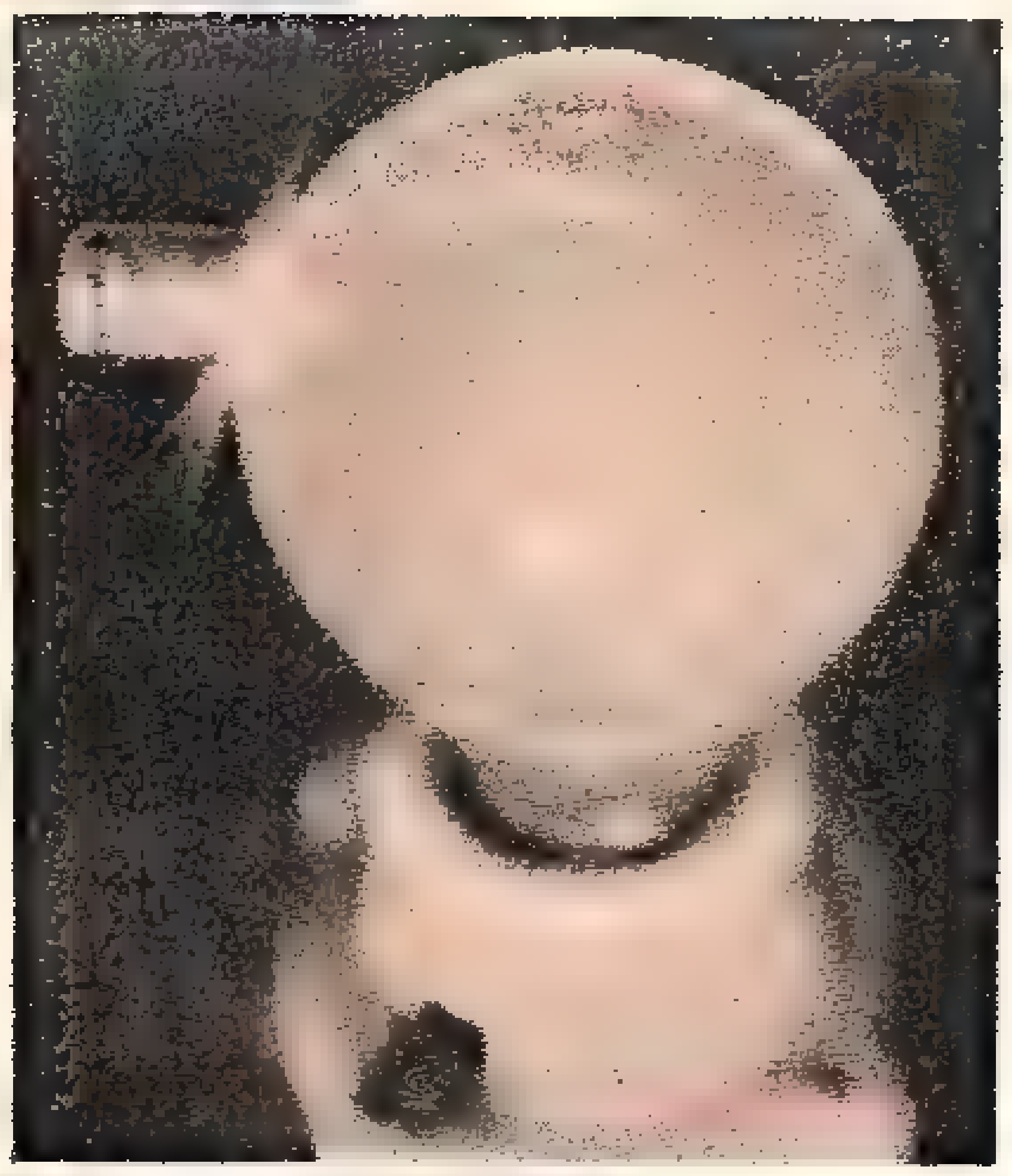
Francis Behn Riggs, Jr., Harvard University freshman and an amateur photographer, examines the ordinary film-pack camera with which he successfully took pictures of a bullet striking a lamp. The pictures were taken in a dark room, using special light-flash apparatus constructed from discarded auto and radio parts. The only purchased item was a special electrical tube costing $12.



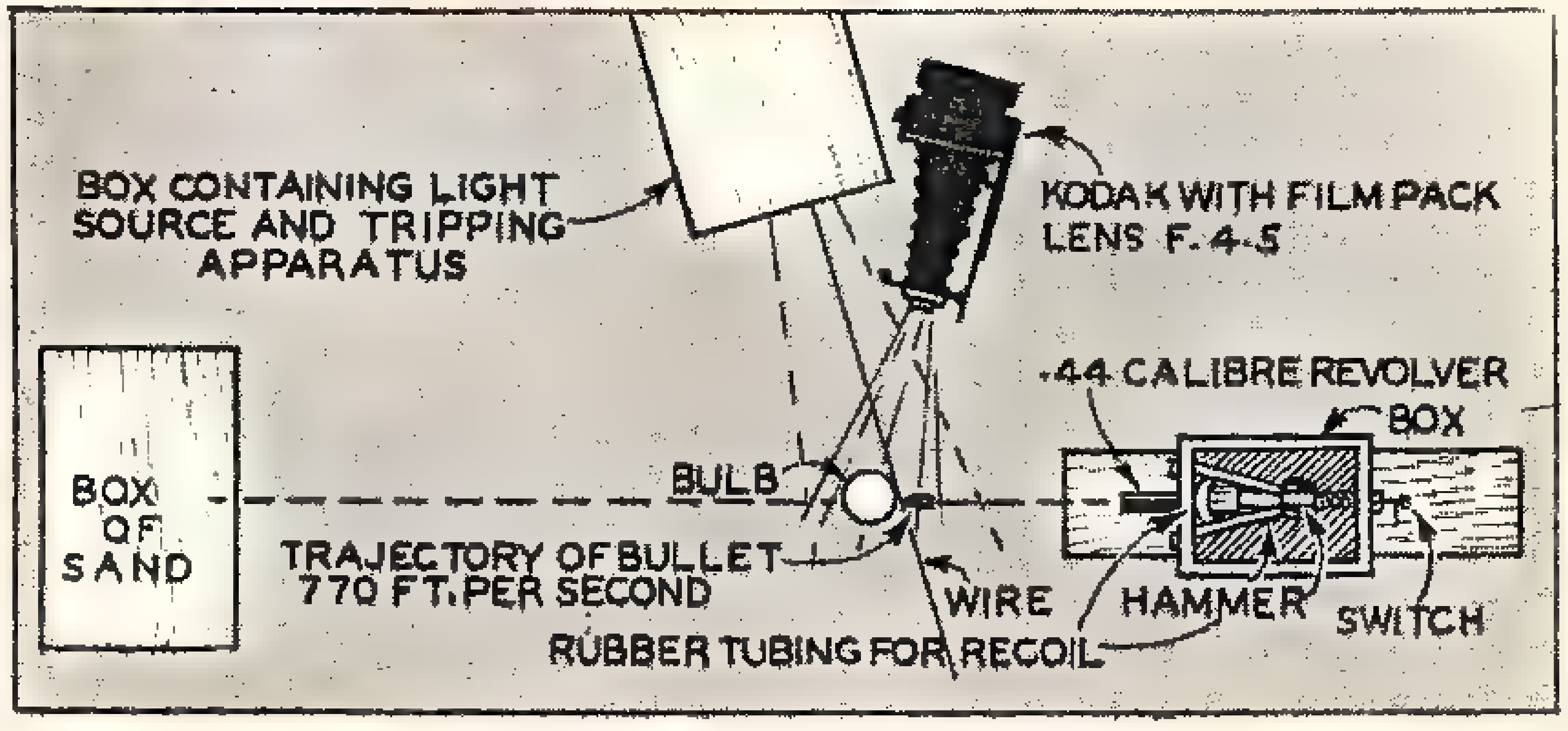
Above—The bulb shatters as the bullet passes completely through it.

USING an ordinary film-pack camera equipped with an F. 4.5 lens and devising a special flash arrangement so that no rapid shutter action was necessary, Francis Behn Riggs, Jr., a 19-year-old amateur photographer attending Harvard University, has succeeded in taking pictures of a bullet striking an electric light bulb. The electrical apparatus used to produce the split-second flash was built by Riggs from old automobile parts, discarded radio sets and other household junk. The only item actually purchased was a special electrical tube, costing about twelve dollars.

To produce a bright flash of short enough duration so that the pictures of the bullet would not be blurred, the young college student rigged up a .44 calibre revolver within a box in such a manner that its bullet struck a wire, connected to the flash apparatus, before hitting the bulb. The bullet, striking the wire and breaking it, tripped the electric flash, providing the one-millionth of a second illumination needed to enable the camera to photograph the bullet in action. A box of sand was used as a backstop to receive the fired bullet, which traveled at a speed of about eight hundred feet per second although Riggs' unusual photos make it appear as though it were standing still. The sketch below shows how Riggs arranged his camera, revolver, light source, and other apparatus in order to take the photographs. The exact point at which to place each object was determined by experimentation.



In the photo above, the bullet was snapped just before it pierced the light bulb. In the photo at the right, the camera caught the whizzing bullet just at the instant it entered the bulb.

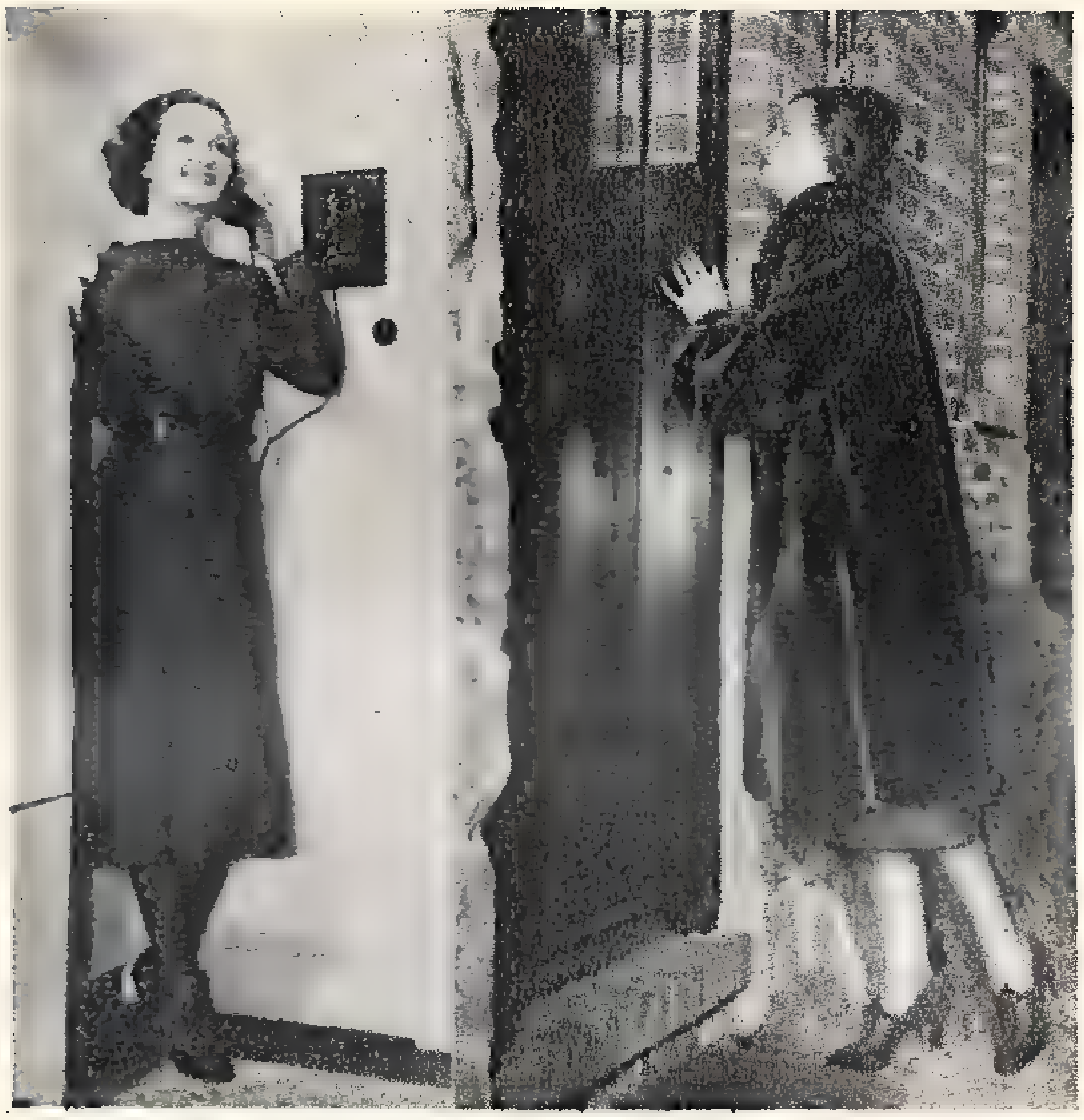

BOX CONTAINING LIGHT SOURCE AND TRIPPING APPARATUS
KODAK WITH FILM PACK LENS F. 4-5
.44 CALIBRE REVOLVER
BOX
BOX OF SAND
BULB
TRAJECTORY OF BULLET 770 FT. PER SECOND
WIRE
HAMMER
SWITCH
RUBBER TUBING FOR RECOIL

Scientist Alternates Light's Color In Experiment

EXPERIMENTS being conducted in Chicago, Ill., by Dr. O. P. Cleaver, who is affiliated with a well known electrical products manufacturer, indicate the possibility that commercial apparatus may soon be produced which, by the mere flicking of a switch, will enable the color of lights in the home to be changed at will. Dr. Cleaver's experiments involve the use of long tubes containing illuminated Argon gas which, by special electrical treatment, he has succeeded in alternately changing the color of from red to blue.

Changing the color of lights in the home by flicking a switch is a future possibility as the result of Dr. O. P. Cleaver's electrical experiments with tubes filled with Argon gas.

Phone Supplements Doorbell



A compact kitchen telephone connected to a loudspeaker-microphone unit mounted on the outside doorjamb enables a housewife to identify callers before admission to the home.

"THE doorbell is ringing, answer the telephone" may sound like a radio comedian's dialogue, but a newly developed house device calls for such advice. The device consists of a special telephone mounted on a wall within a home and a combination loudspeaker-microphone which is mounted in the outside doorjamb.

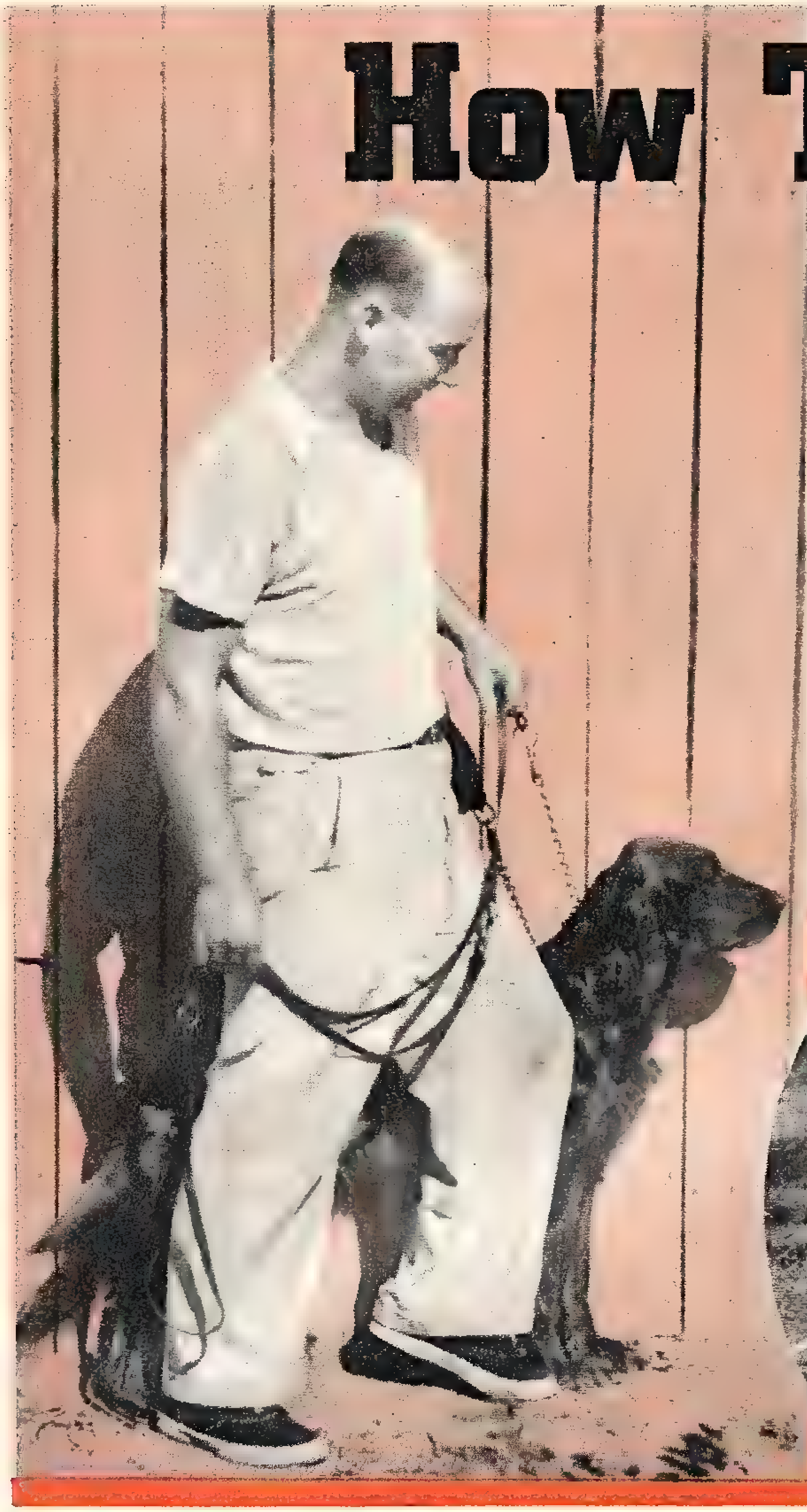
When the doorbell rings, the person within the home speaks into the telephone, asking the caller's identity. The caller, hearing the inquiry through the doorjamb unit, answers directly into the unit, establishing identity. Two way conversation can be maintained as long as desired.

Invents Noiseless Coal Chute

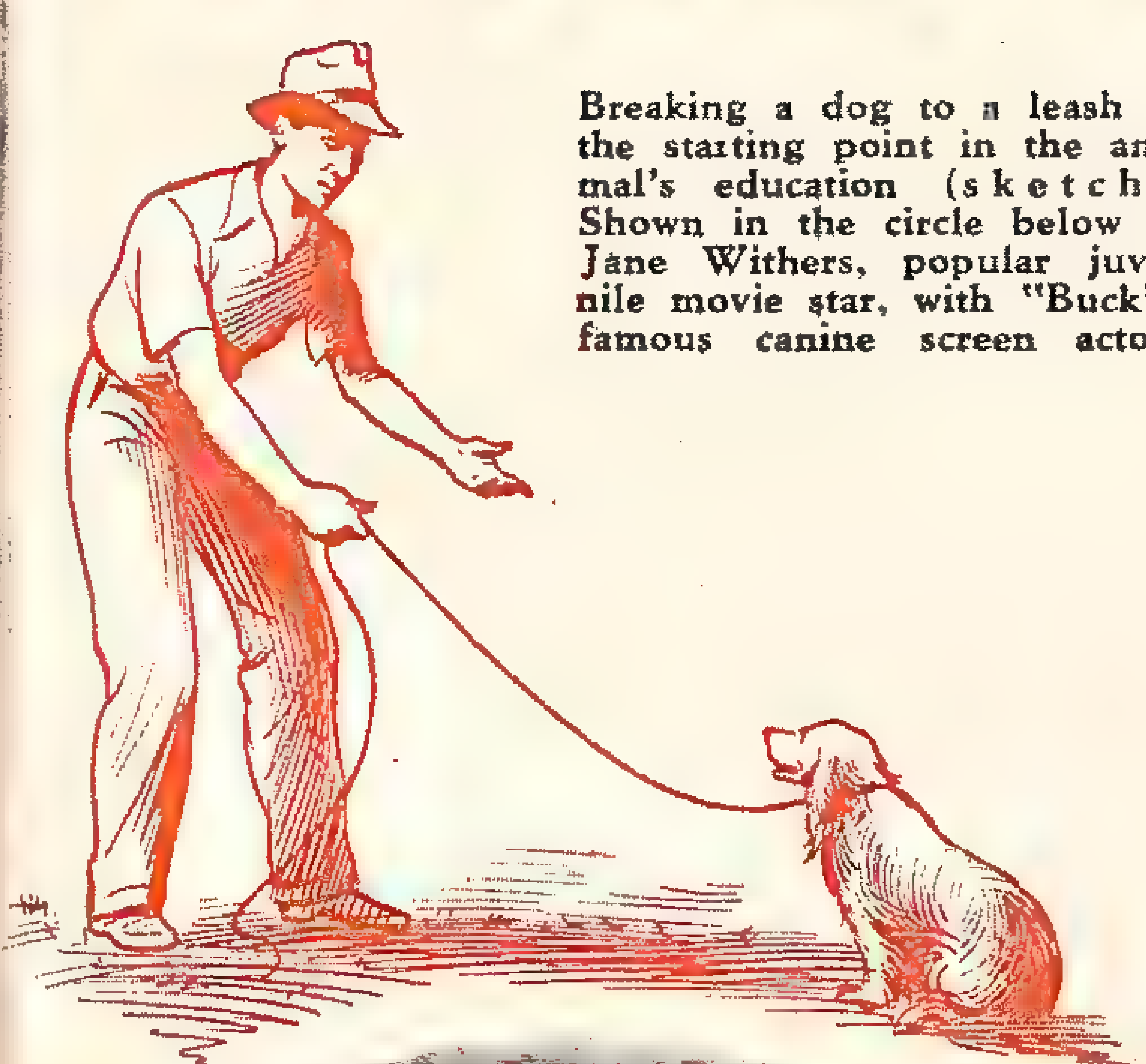
TIRED of the clatter made by coal sliding down a tin chute to basement bins, R. E. Wall, of Winston-Salem, N. C., has invented a slide-type coal unloader which, it is claimed, unloads coal 50 times faster than any other method and—absolutely silently. The new unloader consists of a chute constructed of special composition material.

Constructed of special composition material, this new chute is said to eliminate the noise caused by coal sliding to bins.

How To Train



A high board fence can be used effectively when teaching a dog to "heel". By pressing inwardly with his leg, as shown above, the trainer blocks dog's passage, forcing him to retreat until it becomes habit to walk at his master's heels.



Breaking a dog to a leash is the starting point in the animal's education (sketch). Shown in the circle below is Jane Withers, popular juvenile movie star, with "Buck", famous canine screen actor.

YOUR dog may not be cut out for the movies but he can become an obedient, well-mannered pet if you adopt the training methods suggested by Hollywood's ace canine instructor.

His name is Carl Spitz and he has spent more than twenty years in preparing dogs for police and Red Cross work, "Seeing Eye" duty, the stage and motion pictures. The effectiveness of his methods may best be shown by the success his dogs have achieved in numerous motion pictures.

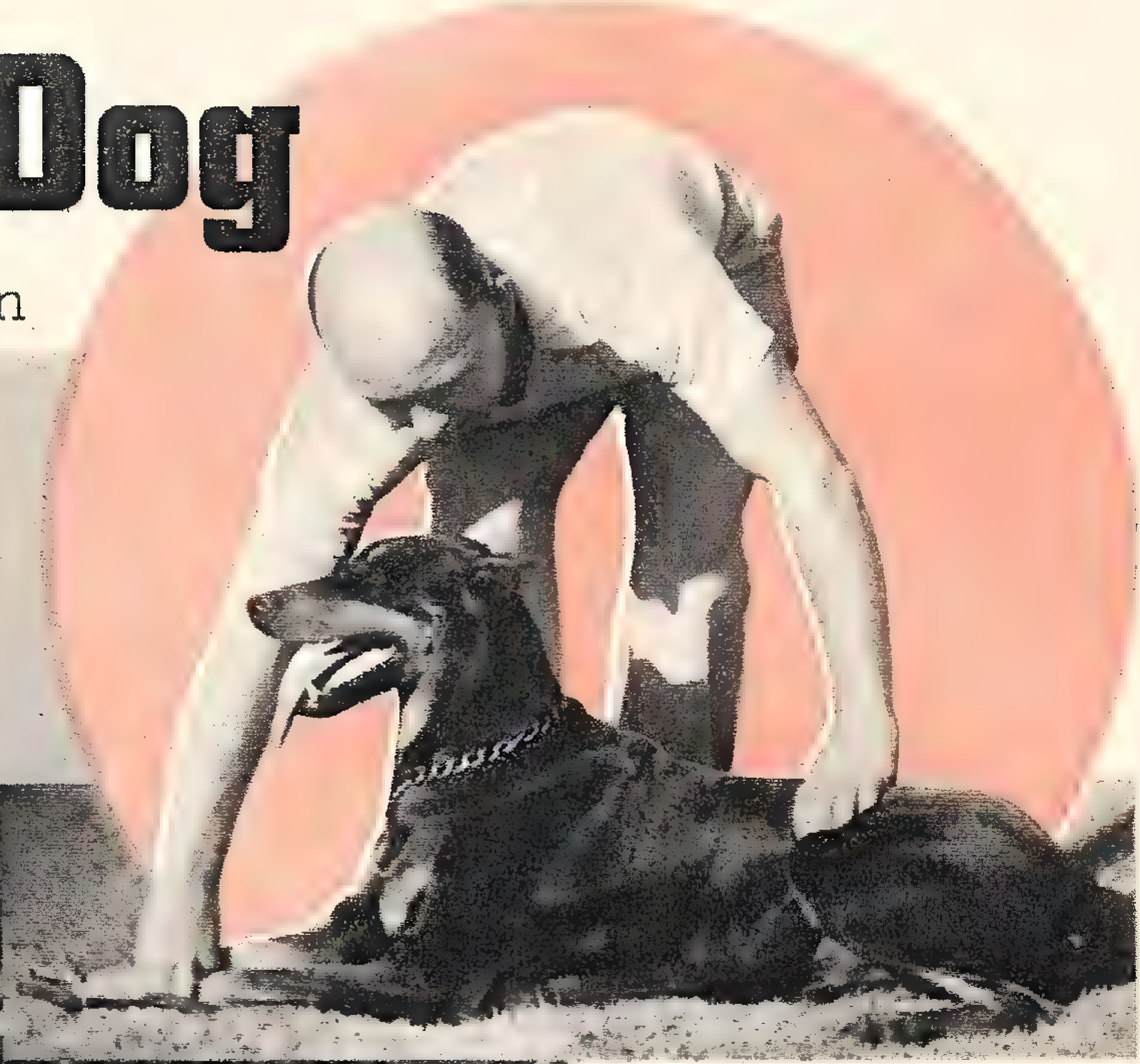
At the film studios, Spitz is an institution and whenever a script calls for a dog, one of his pupils generally gets the assignment. They have appeared in more than fifty-five motion pictures.

The stars of his troupe, Buck, a St. Bernard, and Prince, a Great Dane, move from one set to the next in the manner of busy human stars. They are products of the film training school operated by Spitz and his co-worker, Fritz Bache. It is one of the most complete layouts in America and the kennels are modern, to say the least. They are even equipped with radios to provide music, which, Spitz says, they enjoy. But one radio also serves a more practical purpose. It is connected up to a microphone at the trainer's bedside, and when a dog starts barking during the night he can be silenced by a blast

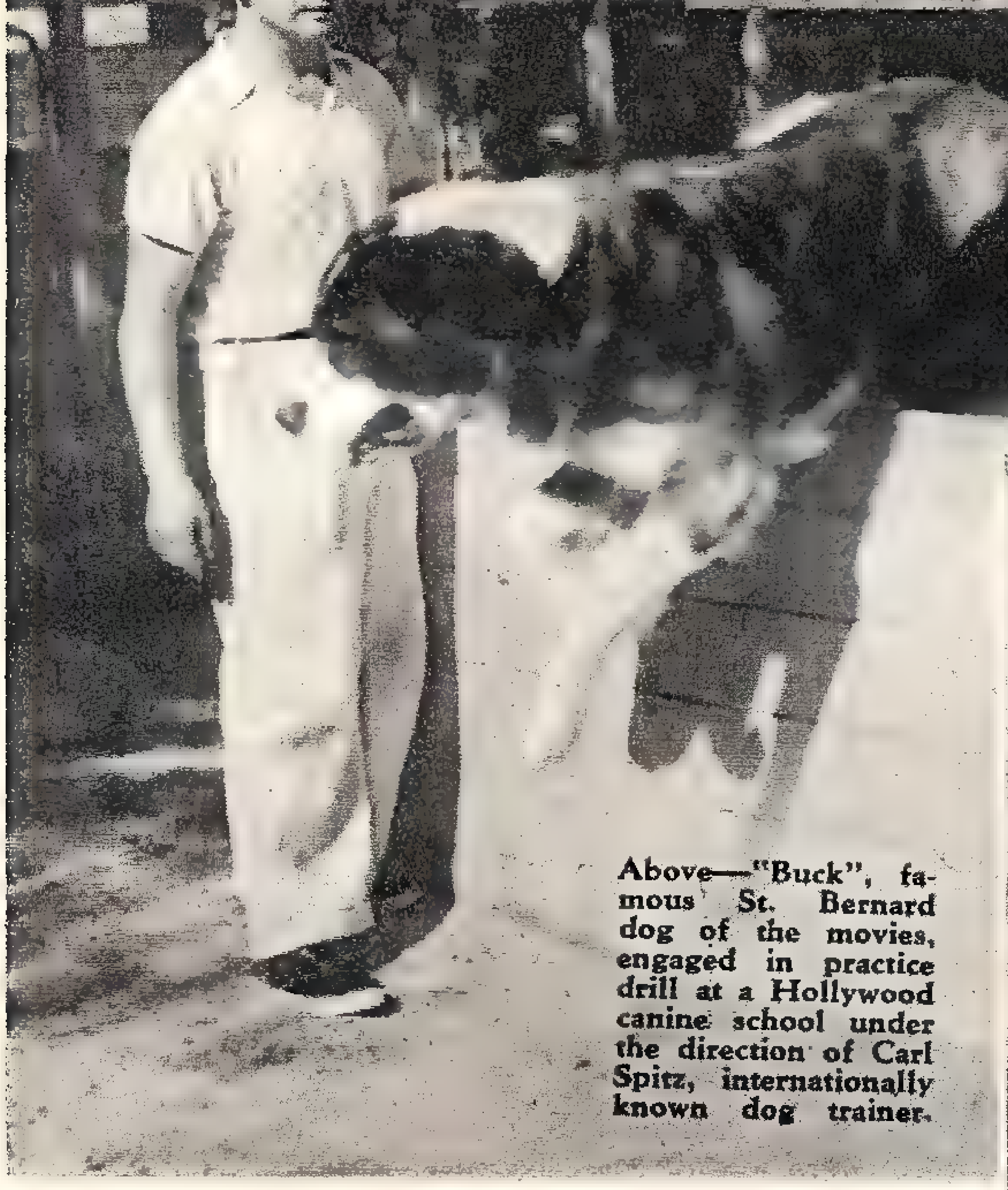
Your Dog

by Marty Soden

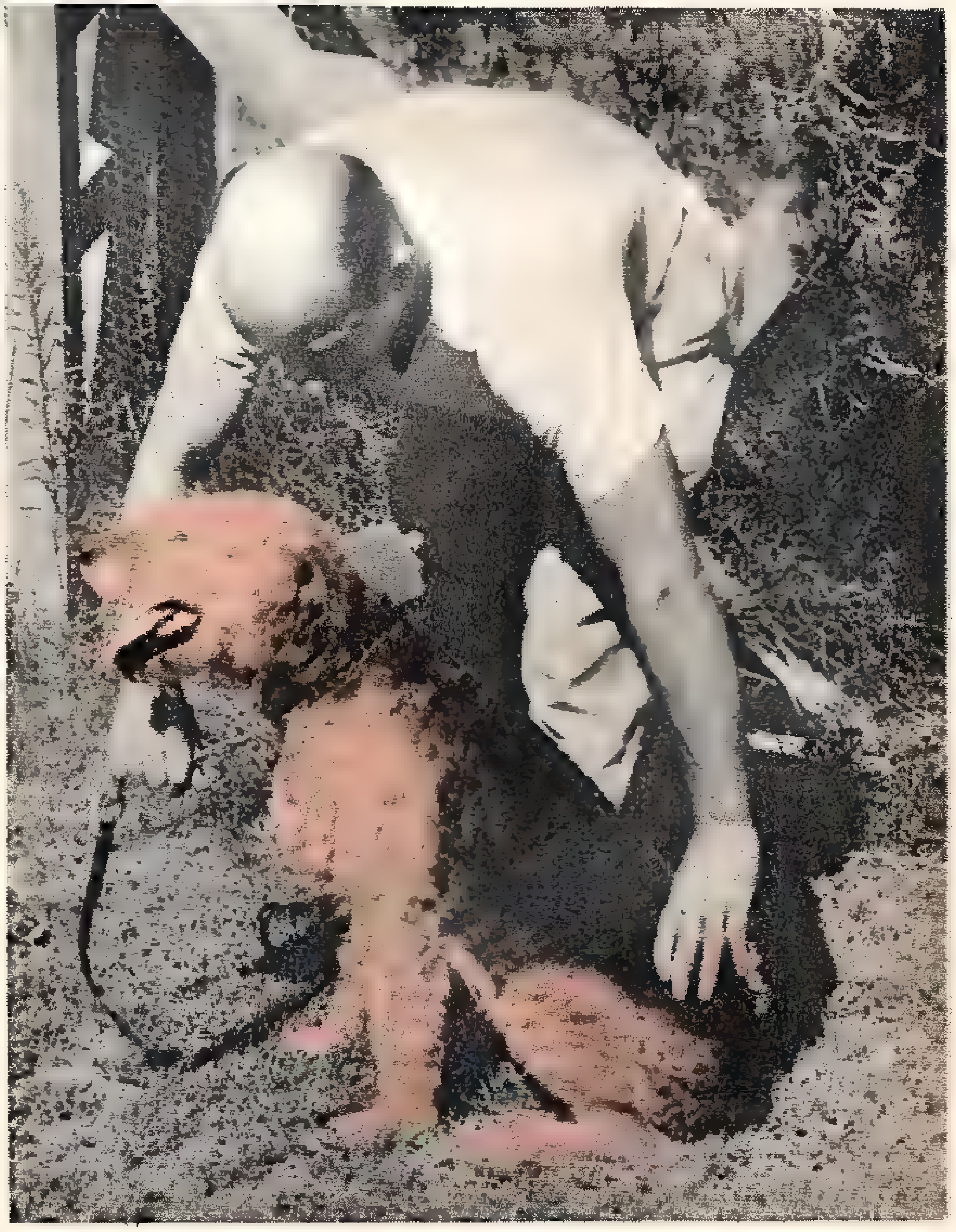
Daily lessons will make your dog an obedient pet.



A canine "pupil" can be taught to sit down on all fours by grasping his two front paws with right hand and stretching him out with the other, as shown above. Exerting a small downward pressure on a dog's hind quarters while holding leash, as shown below, teaches the animal to sit. The lessons must be repeated daily until the dog associates the actions with your orders.



Above—"Buck", famous St. Bernard dog of the movies, engaged in practice drill at a Hollywood canine school under the direction of Carl Spitz, internationally known dog trainer.



on a whistle or a sharp rebuke from the reclined trainer.

Spitz believes a dog's education should parallel a human's and consequently his pupils are separated into three divisions—grammar, high school and college. A film contract usually awaits the college "graduate." Once in a blue moon a student completes his academic work with flying colors and gives his owner income tax worries due to the "star's" salary.

The preliminaries in a dog's education are most important, Spitz says. The ABC's must be learned and learned well if a dog is to be properly behaved.

Breaking a dog to a leash is the starting point in his education. There is a lot more to this than the average owner imagines. In fact, it is the foundation on which the whole of canine training rests. Just because a dog does not object to a leash is no sign he has been properly broken to it. There shouldn't be a constant straining and pulling on the dog's part, nor should the owner be required to jerk sharply on the strap every time he wants the dog to halt. If properly leash-broken, the dog walks without the slightest consciousness of its presence. With his attention centered upon his master, he is responsive to his slightest movements.

The dog does not give orders—he obeys them. When a dog is being taught simple commands he should be kept on a leash. It aids him in keeping his mind on the work at hand and checks his tendency to investigate all outside distractions.

Training a dog to sit down can be effected by holding the leash short in the right hand and placing the left hand, in the shape of a tongue, just above the hind quarters. Then, by exerting a small amount of pressure in a downward movement, the trainer gives the command "Sit"—not "Sit Down." Naturally, the dog will try to squirm away but he will be unable to do so because of the pressure of your hand on the small of his back. Likewise, if he tries to lie down all you have to do is pull up on the leash. This lesson should be repeated over and over for several days until it becomes second nature to the dog and always the same command should be given. Spitz believes all commands should be as simple as possible in order not to confuse the animal during the training period.

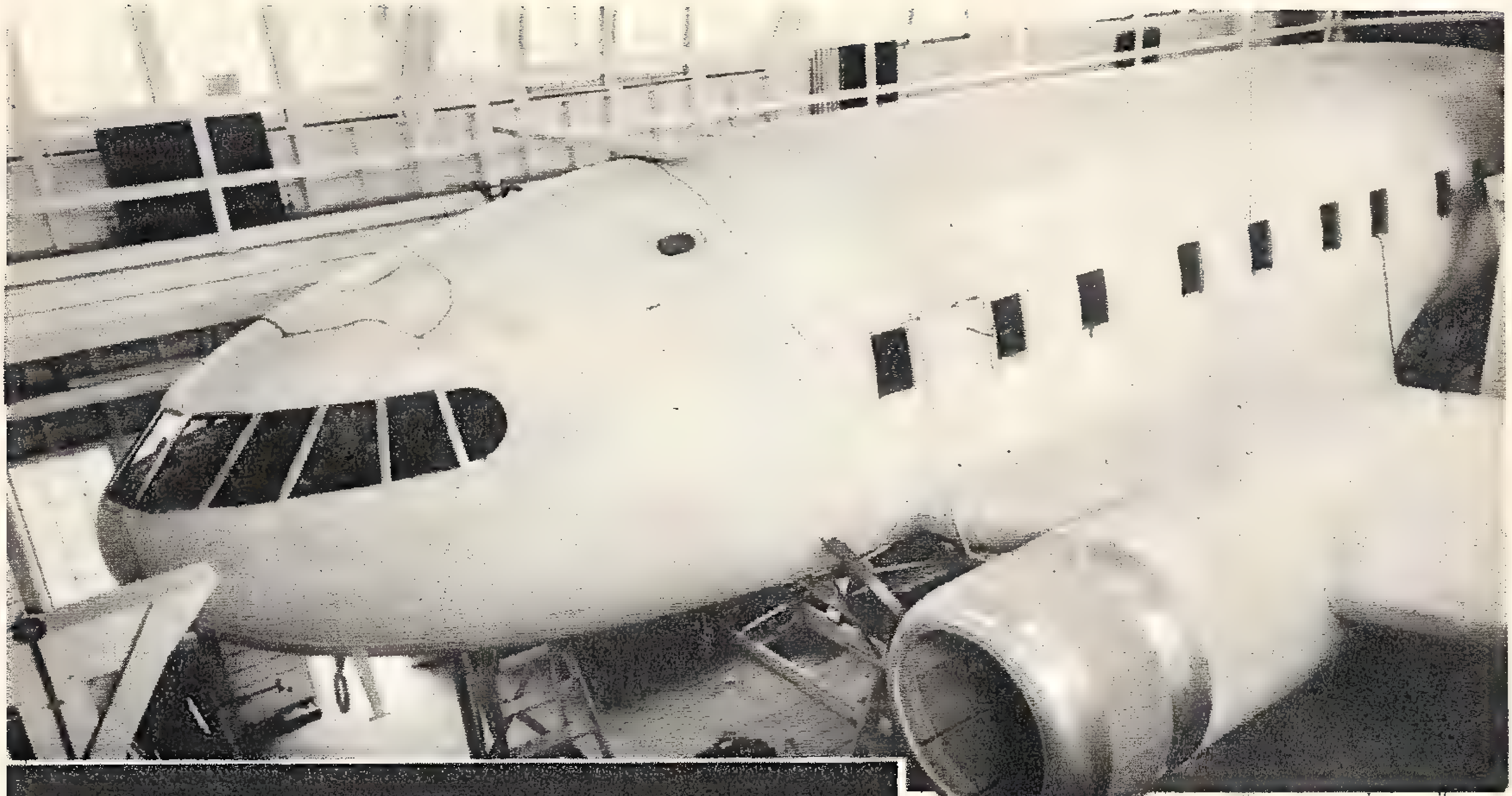
"Buck" studies his lessons.

It is an easy matter to get the canine pupil to sit down on all fours by holding the leash in the right hand and grasping the dog's two front paws with the other, stretching him out until his body is on the ground. Here the command is "Down."

To get the dog to remain in this position may require a little extra patience on the teacher's part the first three or four times. When starting out, he should drop the leash gently and back away from the dog a few steps. While doing this he should have the dog's full attention and impress upon him the fact that he is to remain in the position placed. If he gets up, the routine should be repeated. By widening the gap between the dog and trainer by degrees, the idea will be drilled into the dog. With the aid of a clothes line, a dog can be taught to come when called. With one end of the rope affixed to his collar and the trainer holding

[*Continued on page* 124]

Connected to a loudspeaker in his kennels, a bedside microphone enables Carl Spitz, trainer of Hollywood canine stars, to whistle or voice commands that serve to quiet any "pupils" that start to bark during the night or early morning.



A Million Dollar PLANE That Will NEVER FLY

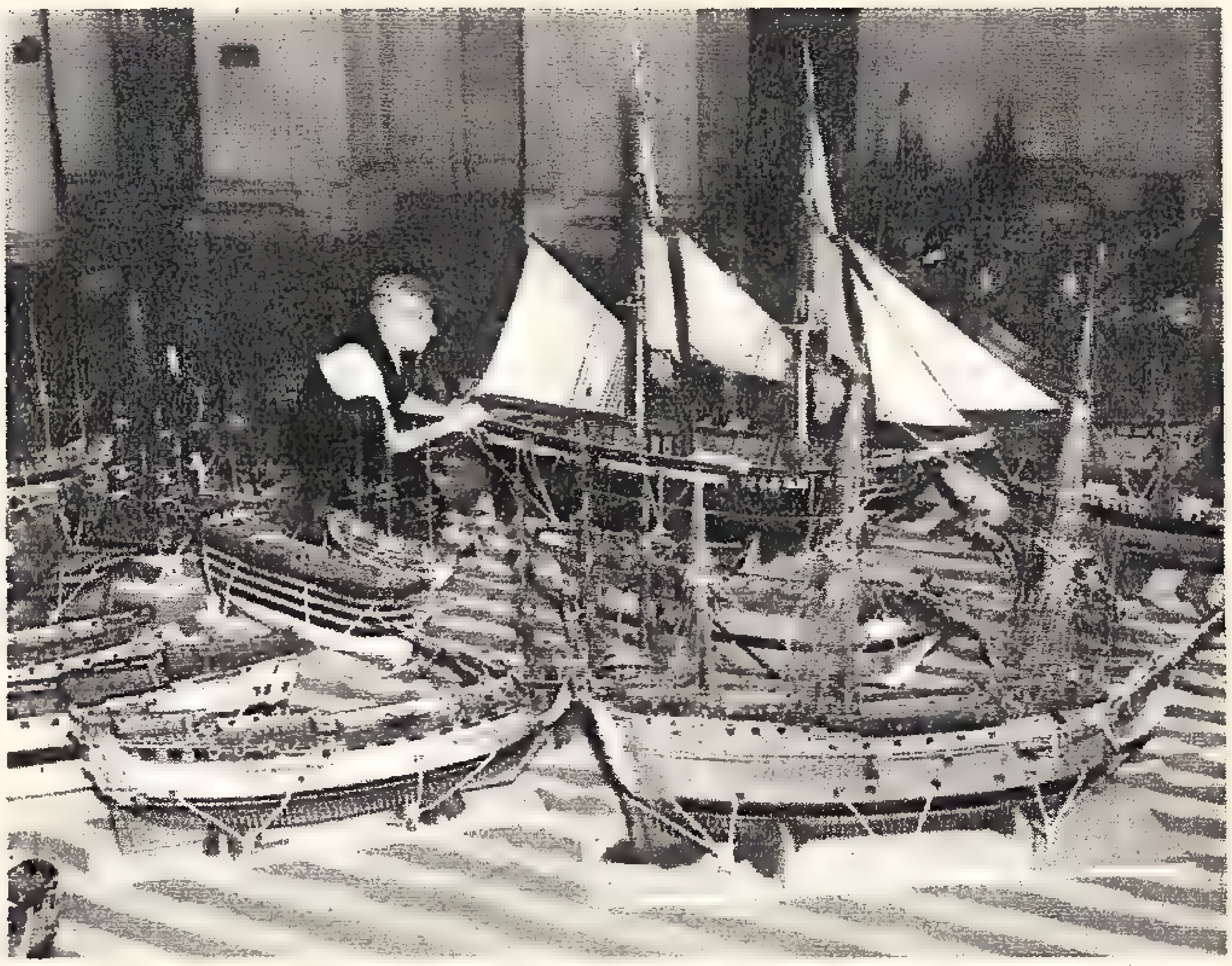
Representing an engineering cost of one million dollars, this "mockup" of a new Boeing air liner is constructed of wood and fabric and will never leave the ground, being just a full-scale model.

The "mockup" air liner was built only to enable engineers to check their design, plan the cabin arrangements, location of berths, etc. The photo at right shows a dummy ladies' room in the huge model.

The new four-engined Boeing will be 74 feet long, with a 107-foot wingspan and will carry 33 passengers at a speed of about 240 m.p.h. For night travel, the air giant will feature 16 large berths, like those shown in the "mockup" (above). To help the engineers decide on the arrangement of the plane's instruments and controls, a dummy panel layout was set up in the "mockup", as shown in photograph at right.

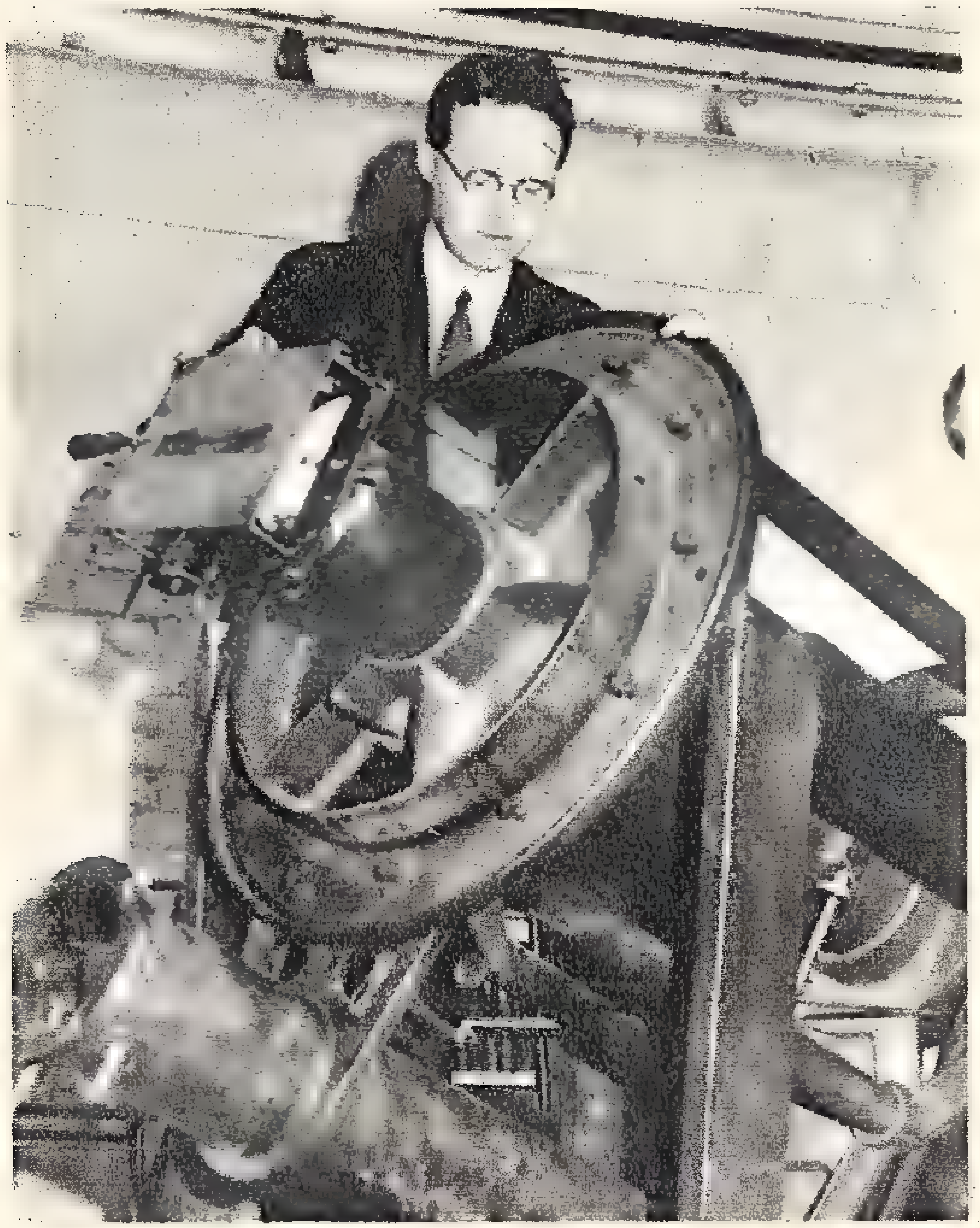
Naval Academy Receives Famous Model Collection

THE United States Military Academy at Annapolis soon will place on exhibition this famous collection of sailing vessels. Assembled by Col. Henry H. Rogers, the collection is valued at $300,000. Fred Avery, model maker who has charge of setting up and displaying the collection, is shown at work on a model of an American Merchantman of the type sailing the seven seas in the year 1875. The workmanship shown by these models can serve as an inspiration to all model builders. The vessels in the foreground show clearly the perfection of the craftsman's work.



The photograph above shows Fred Avery, model maker, working on a model of an early American Merchantman. It is part of a collection to be placed on exhibition at Annapolis.

New Star Has Record Size

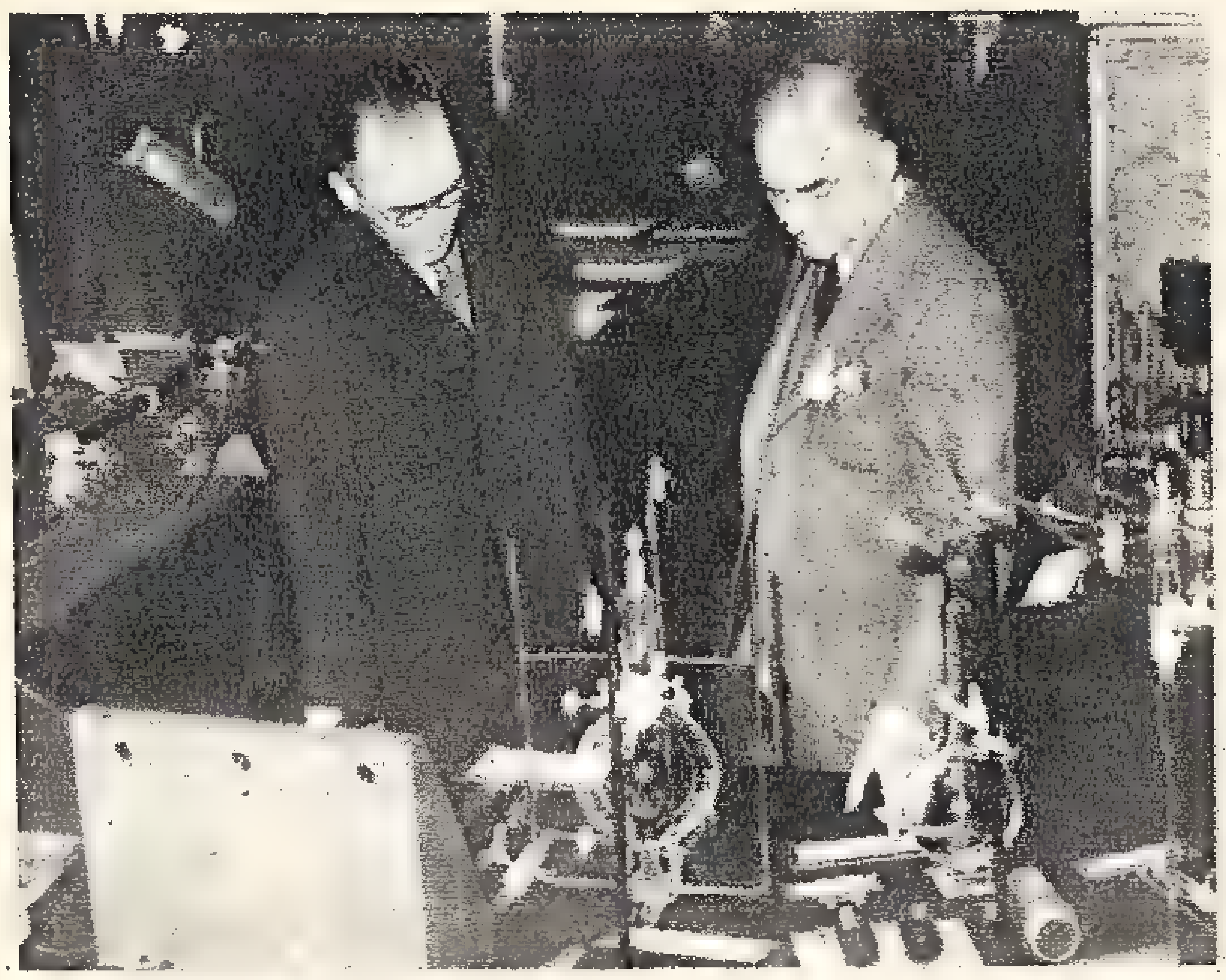


Dr. Otto Struve is shown at the telescope at Yerkes Observatory at Williams Bay, Wis. Dr. Struve discovered the new binary star, a part of which is 2,000 million miles in diameter.

A NEW star, 3,000 times as large as the sun has been discovered by Dr. Otto Struve, shown here at the telescope in the Yerkes Observatory at Williams Bay, Wis. The star is the largest ever reported and has been named "Epsilon Aurigae."

Device Checks Color Change

A NEW machine has been developed that measures the change in colors in an organic compound whose colors change with the acidity. Formerly such changes had to be measured by sight and described as well as the chemist could remember. A demonstration of this device was made at the convention of the American Association for the Advancement of Science, held in Indianapolis, Ind. Professor J. Allen (left), of Purdue University, watches as G. H. Vaneman demonstrates the machine.



Professor J. Allen of Purdue University watches as G. H. Vaneman demonstrates the machine that measures the colors in an organic compound whose colors change with its acidity.

Fibrous Glass Insulates Shoes Against Heat, Cold

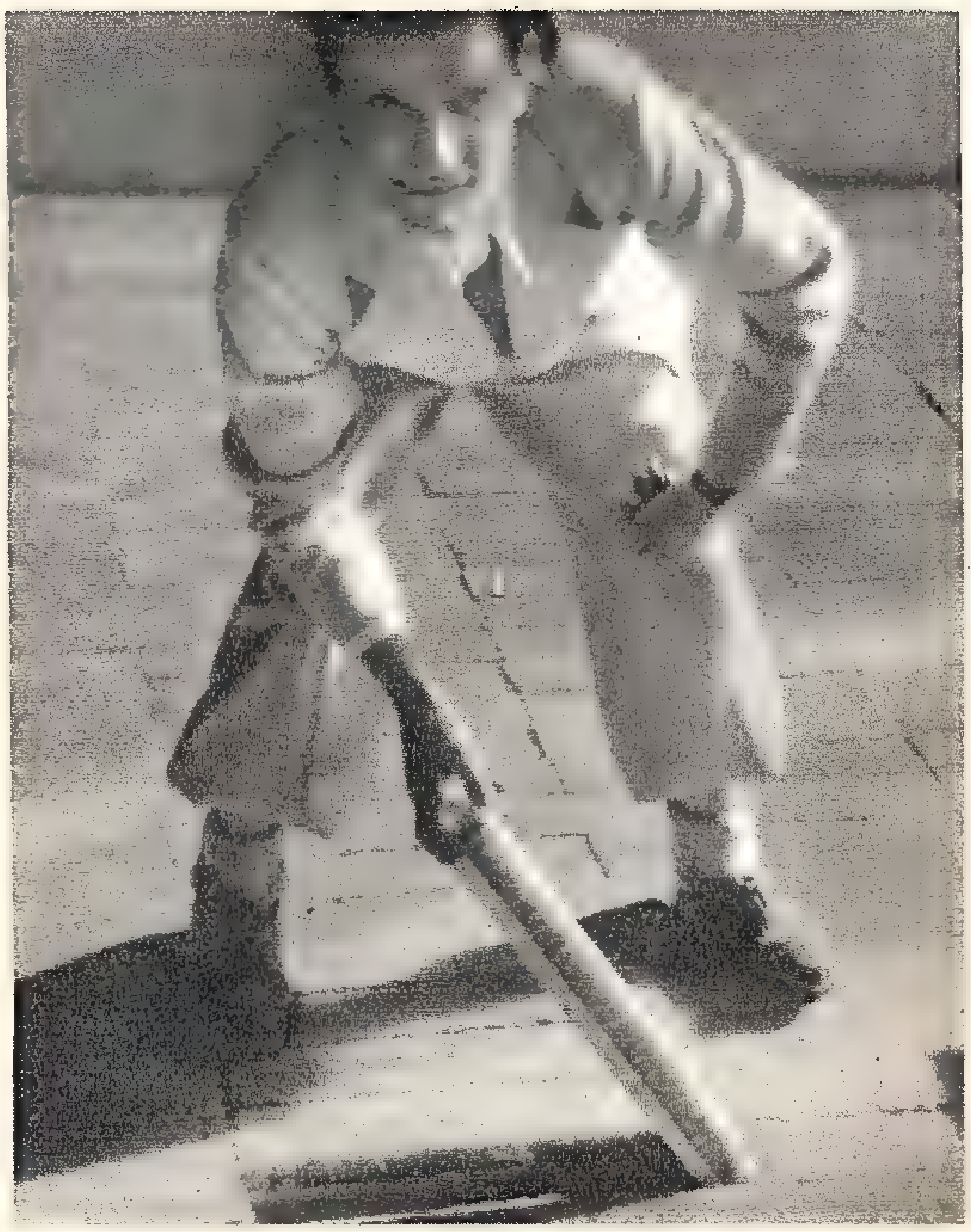
SHOES are now to be insulated against heat and cold just the same as houses, stoves, refrigerators, and trains—with glass in fibrous form, the manufacture of which was explained in an article that appeared in the February issue of MODERN MECHANIX.

Months of testing shoes insulated by spreading fibrous glass between the insole and outsole and worn by patrolmen of the Columbus, Ohio, police department on sizzling summer pavements and in snow and slush during winter months, has convinced a shoe manufacturer that he has hit upon a revolutionary construction feature, and so glass-insulated shoes will be introduced nationally during 1938. Tests with a thermocouple device indicated a temperature variance of 20 degrees between glass-insulated shoes and the ordinary kind.

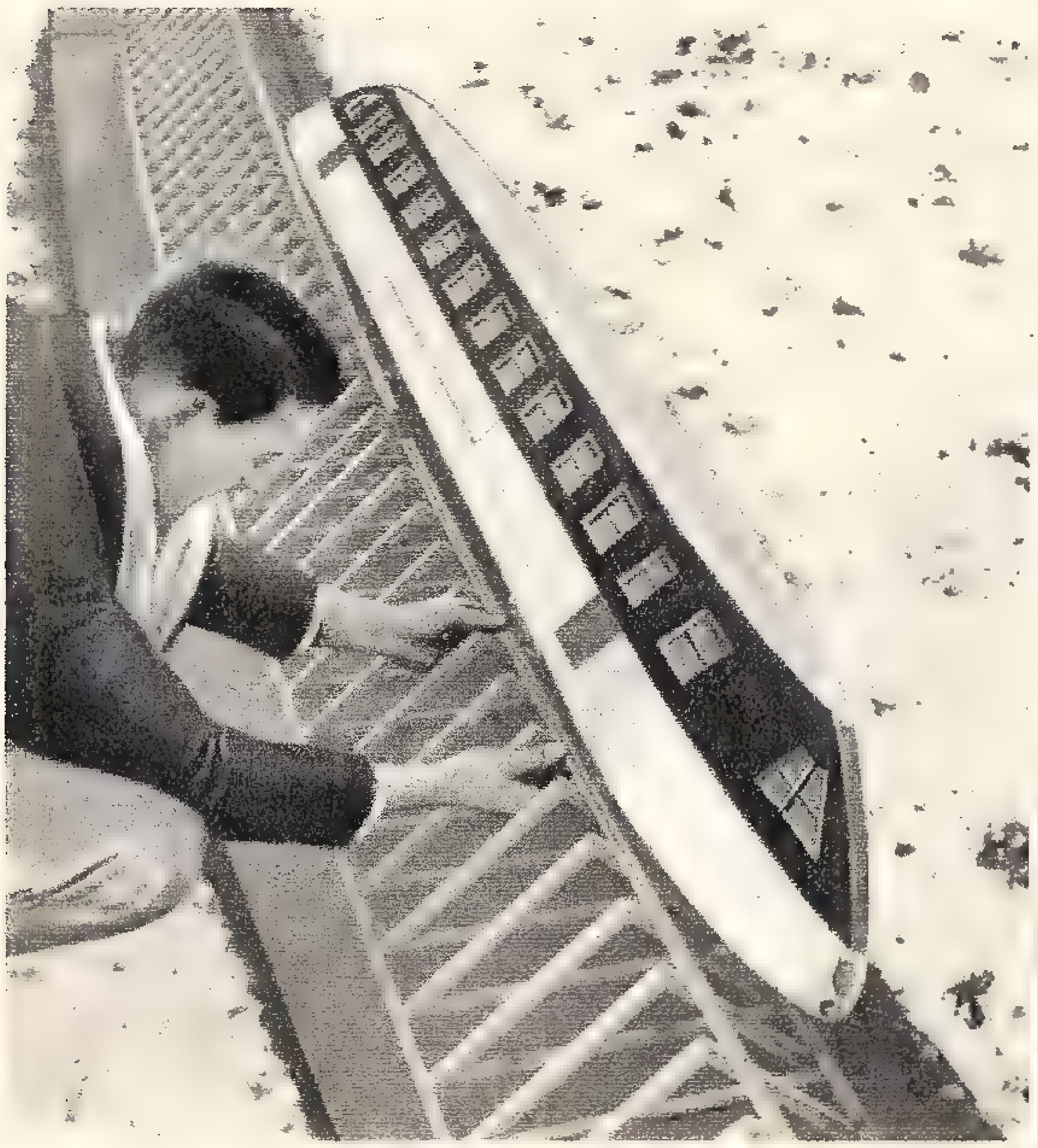
Inserted between the soles of shoes, as shown above, fibrous glass effectively insulates the feet against heat and cold. Left—Checking the temperature within an insulated shoe with a thermocouple device.

Scrubbing Brushes Used As Surface For Ski Slide

INDOOR ski training slides have been constructed of waxed wood, straw, and various other materials, but a slide recently developed in Germany is believed to be the most novel of all inasmuch as it features 4,500 upturned scrubbing brushes (right), the hard bristles serving effectively as a surface for the slide. The resiliency of the bristles enables the skiers to "crab" back up the slide, as shown in the photograph below.



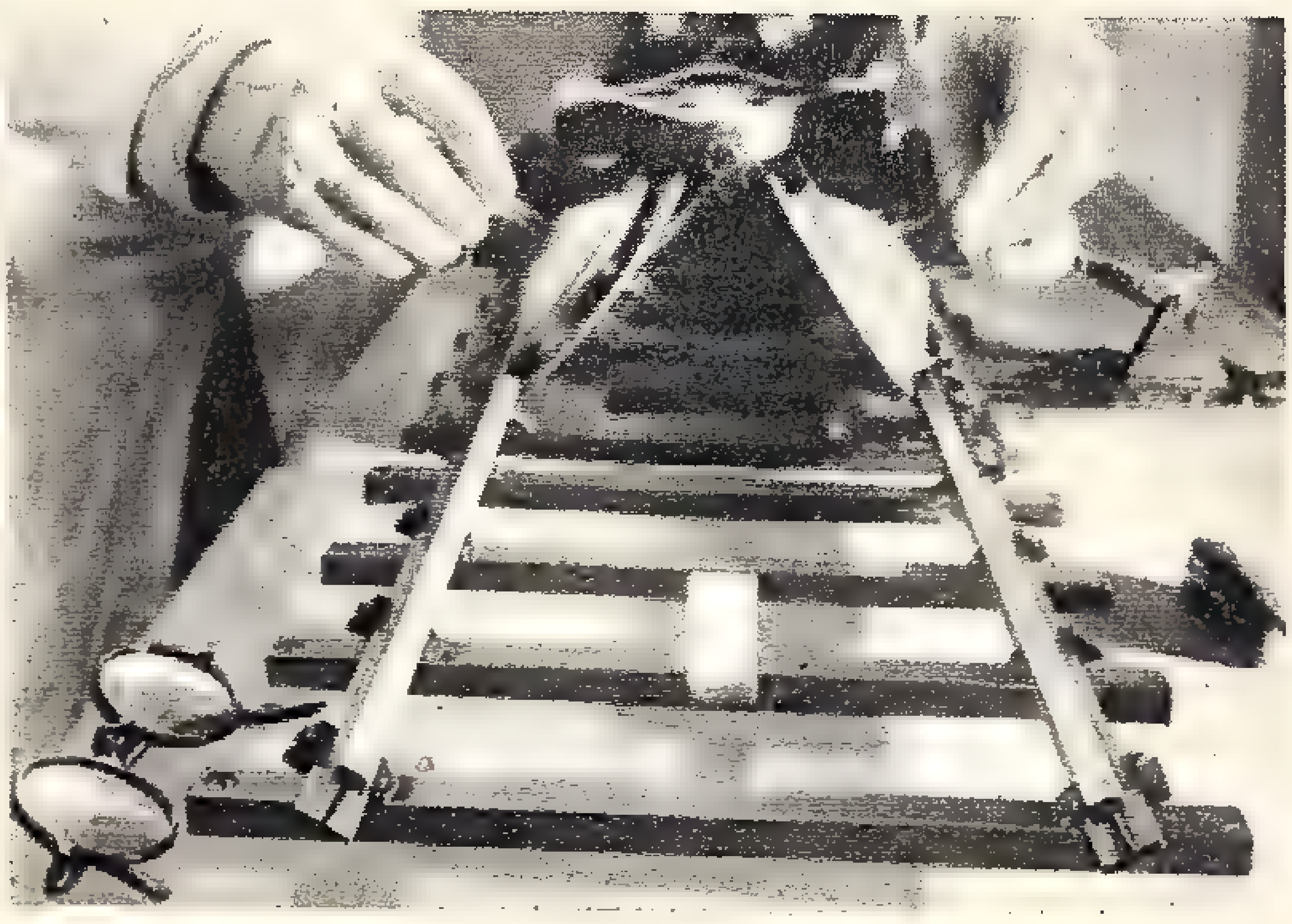
Model Of "Super" Railway Car Travels 70 M.P.H.



Banked curves (above), inclined car wheels and tracks are features of a new railway designed by a college professor in Switzerland. This model, used to demonstrate the practicability of the design, attained a 70 m. p. h. speed over a 900-foot track.

A SCALE model of a new type "super" railway car, which attained a speed of 70 m.p.h. over a specially constructed 900-foot track, has been constructed by Professor Kurt Wiesinger, technical lecturer at Zurich University in Switzerland. This corresponds to an estimated speed of about 230 m.p.h. for a full size car of like design. The scale-model car is four feet in length and is powered by a small gasoline engine.

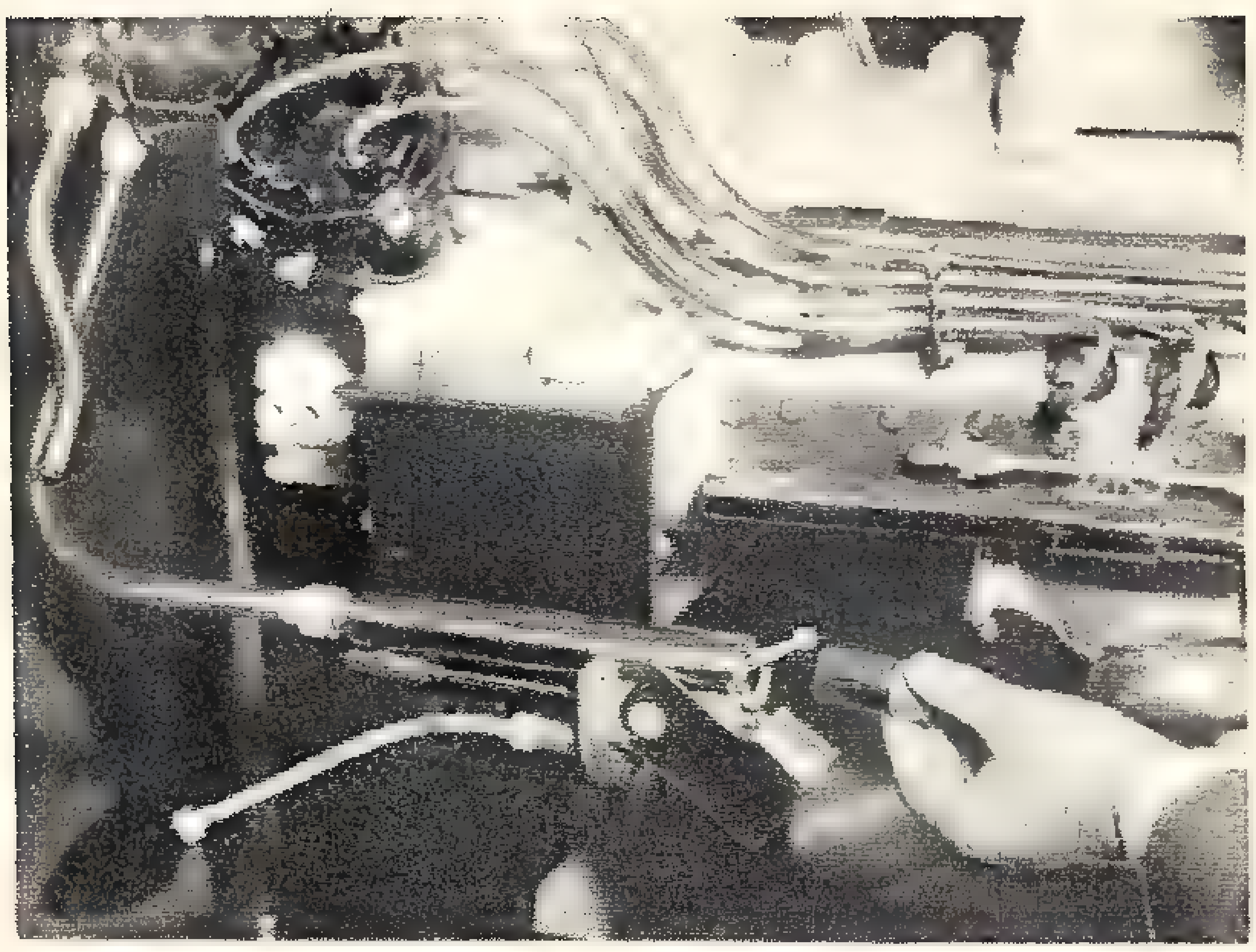
A full size railway car built to Professor Wiesinger's design would weigh only about one-fifth that of a present day car, according to the inventor. In order to prevent derailment, the wheels of the car and the tracks over which it would travel would be inclined inwards at an angle of about 30 degrees, as shown on the model railway car in the photograph above.



Close-up showing car's inclined wheels and tilted tracks.

Cartridge Starts Up Engine

CAPABLE of starting any gasoline engine up to 600 horsepower in size, a new type "cartridge" starter has been devised by a well known manufacturer. The starter features a series of long tubes connected to a cylindrical chamber, which opens up to receive a special cartridge much in the manner of a gun breech. Detonation of the cartridge creates a powerful air blast in the tubes, serving to turn over the crankshaft.



Loaded like a shotgun, a new gasoline engine starter features a cartridge which is detonated to turn over the crankshaft.

Novel Ice Bag For Face

A NOVEL ice bag that looks like a pair of over-grown eyeglasses and which may turn into the latest method for treating facial troubles adjacent to the eyes, ranging from sinus infections to the well-known "shiner," has been patented by a Washington inventor. The bag consists of two miniature "balloon tires" connected by a bridge which rests across the wearer's nose.

A list of addresses of manufacturers of items mentioned in MODERN MECHANIX will be sent to any reader upon receipt of a stamped, return envelope.

WAR ON CANCER Advances

One of the "weapons" used by scientists in their war on cancer is radon, a gas derived from radium. It is created in the odd-looking apparatus shown in top photo. Right—Powerful X-ray apparatus enables doctors to treat deeply rooted cancerous growths.

RANKING second only to heart disease in its mortality rate, cancer has long balked the efforts of the medical profession to discover a positive cure. Nevertheless, the war on cancer continues unabated in hundreds of laboratories and hospitals throughout the world.

Surgical removal of cancerous growths, either by X-rays or radium treatments, has been used for many years. However, there have been notable advances made in this form of treatment recently, the most outstanding being the development of powerful X-ray apparatus using one million volts, enabling the rays to reach deeply rooted cancer-ridden parts of the body.

The lead case with round slots, shown at right, carries gold "seeds" filled with radon. The slots are numbered to indicate the strength of the capsules they contain. The needles are used for planting the "seed" in cancerous growths. Above—A technician's hand holds a pair of long-nosed forceps, which grasp a hair-thin gold tube filled with radon.

Model Railroad Hobby Grows Into Paying Business

L. G. Jenkins stops his engine before a miniature water tower for refilling tanks. The locomotive was built in 1907 for the Jamestown Exhibition, and is capable of a 40 m.p.h. speed.

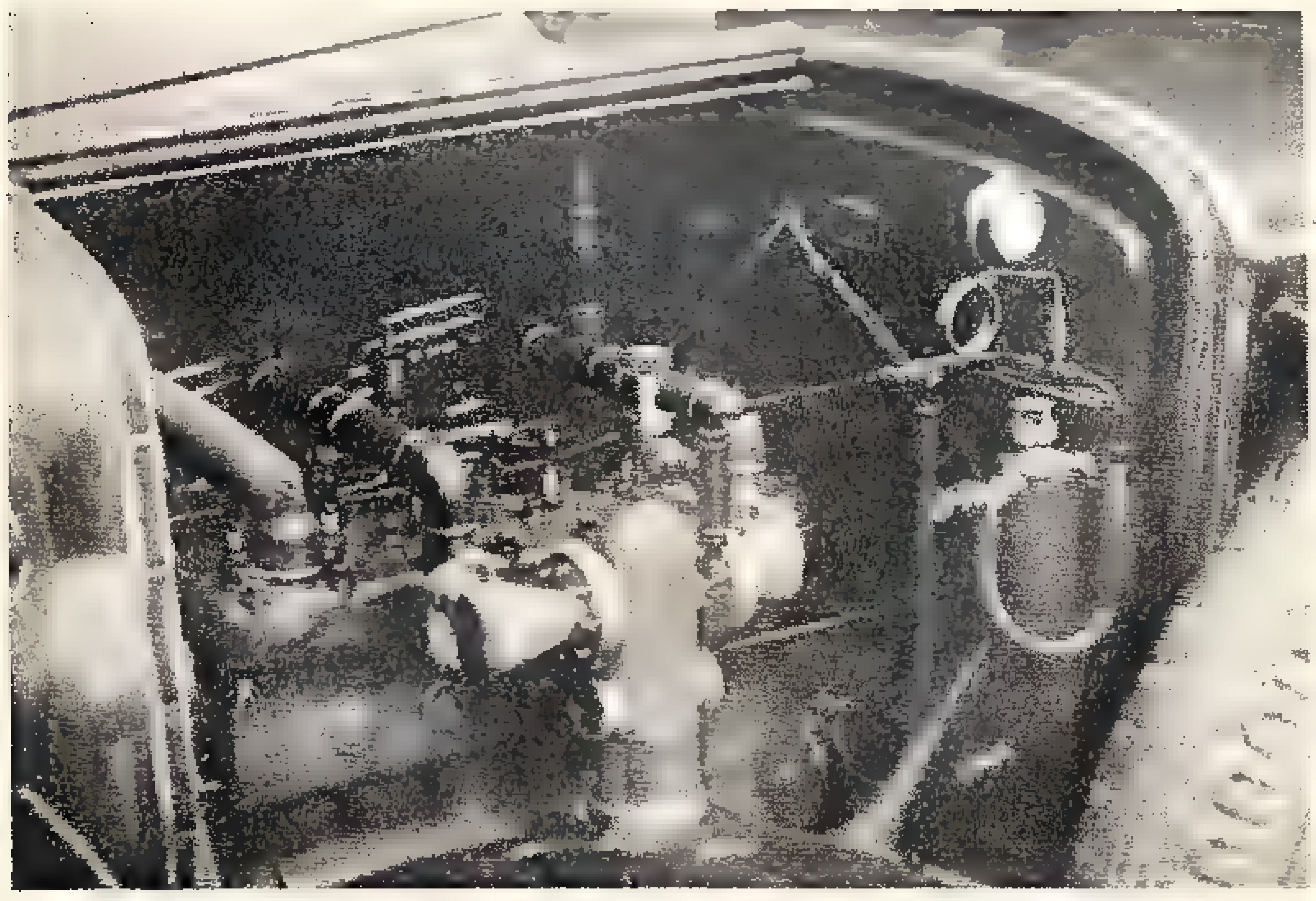
THE Jenkins Railway System has grown from a hobby to a paying business, having taken in $5,000 during the past four years. Built by Baldwin in 1907 for the Jamestown Exhibition, the train was found in a shed in Greensboro, N. C., by L. G. Jenkins of Star, N. C., who promptly purchased it and set it up on a quarter-mile 15-gauge track which encircles his yard.

The business end of the railway has grown gradually. Mostly the railway is fun for Mr. Jenkins, who acquired it because he never outgrew his fondness for toy trains, and for the conductor and assistant conductor, Junior and Billy Jenkins, aged 12 and 6.

Popularity of the small train has increased patronage so much, and vacationists on the highways alongside the train are stopping, looking and riding in such numbers, that the system is now moving to a larger lot.

Acetylene Becomes Car Fuel

TWO ingenious mechanics, brothers Anthony and Michael Fonzo, recently astounded Rome with what is said to be the first automobile to run on acetylene gas. This fuel is claimed to be superior to other motor fuels and it is said that very little residue is left after it is burned.



The engine of what is said to be the first automobile to run on acetylene. This new fuel is claimed to be superior to other motor fuels. Very little residue is left after acetylene is burned.

Giant Tire Aids Road Making

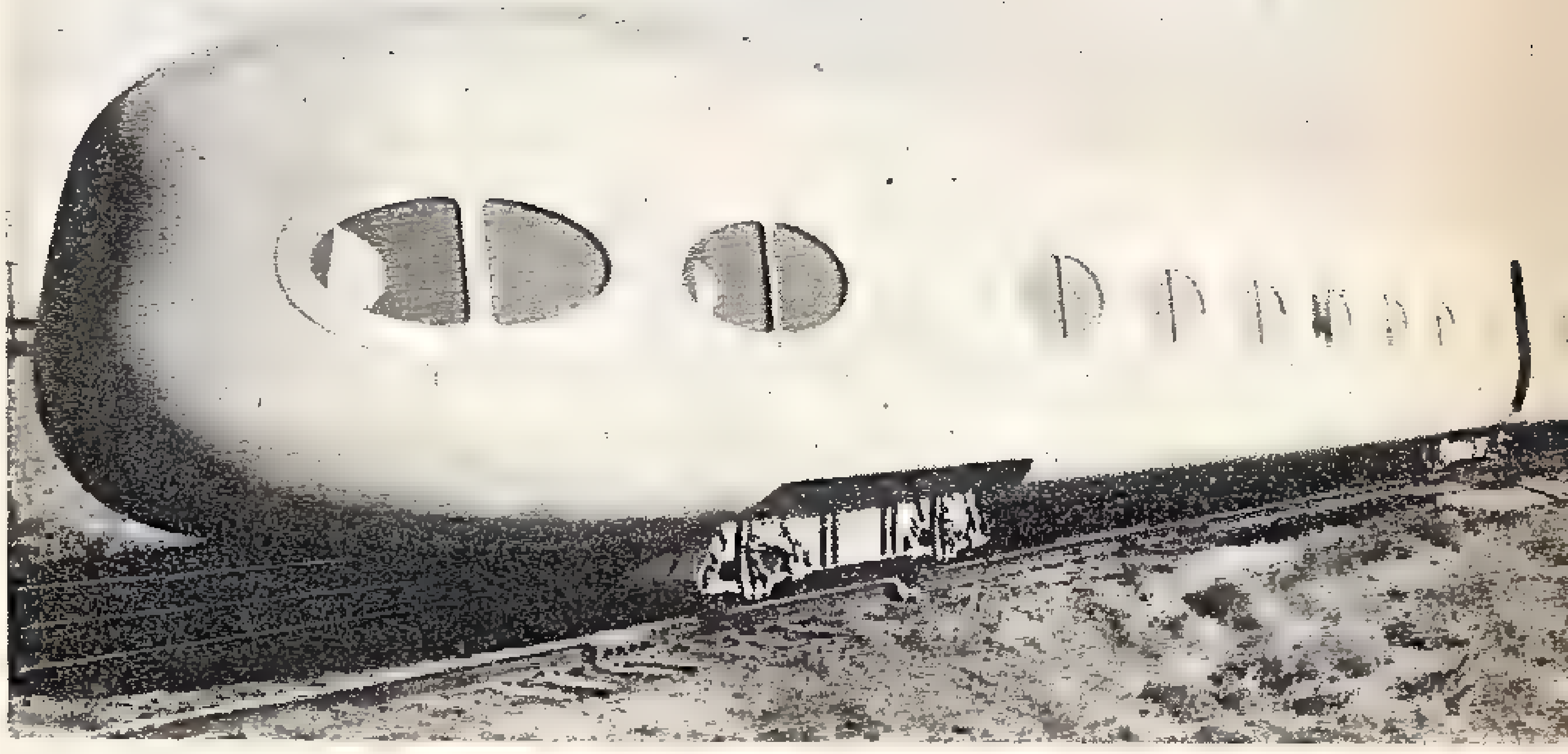
This giant tire is one of many which were designed and constructed to replace metal wheels on road building equipment. Note depth of tread, indicating ability to "bite" into ground.

ONE of the giant tires of the type which is displacing metal wheels on road building equipment, with its more than four-foot diameter, affords a hiding place for five-year-old Ellis Ebersole, shown sitting in the hub space.

"Pendulum-Type" Streamlined Coaches Tested

TRAVELING without a jounce over a ten-mile stretch of spur-line trackage near Inglewood, Calif., their light bodies swinging on special supports, two new "pendulum-type" streamlined railway coaches recently completed test runs to determine their practicability. The two coaches are mounted on three rail-trucks, so as to form one essential unit. The center of gravity of each coach has been lowered, and the special truck-mounting supports enables them to be banked on turns.

The coaches measure 149 feet overall and weigh less than 60,000 pounds as compared to the 88,000-pound weight of streamlined coaches now in use.



Featuring pendulum-type supports, these two new streamlined railway coaches are mounted on only three trucks. The special mounting enables the coaches to bank when rounding curves.

Loudspeaker Aids Fire Chief

Speaking into a hand microphone connected to a powerful 100-watt amplifier, Chicago's fire marshall is able to efficiently direct his men's activities despite noisy confusion.

A SPECIALLY designed 100-watt loudspeaker mounted on a swivel atop the cab of a light-generating truck enables the voice of Chicago's fire marshall to be heard for several blocks above the din and clatter that is present at all big fires. The power amplifying equipment is housed within the truck and is independent of the truck's power supply system. A hand microphone is connected to the loudspeaker by a long cable.

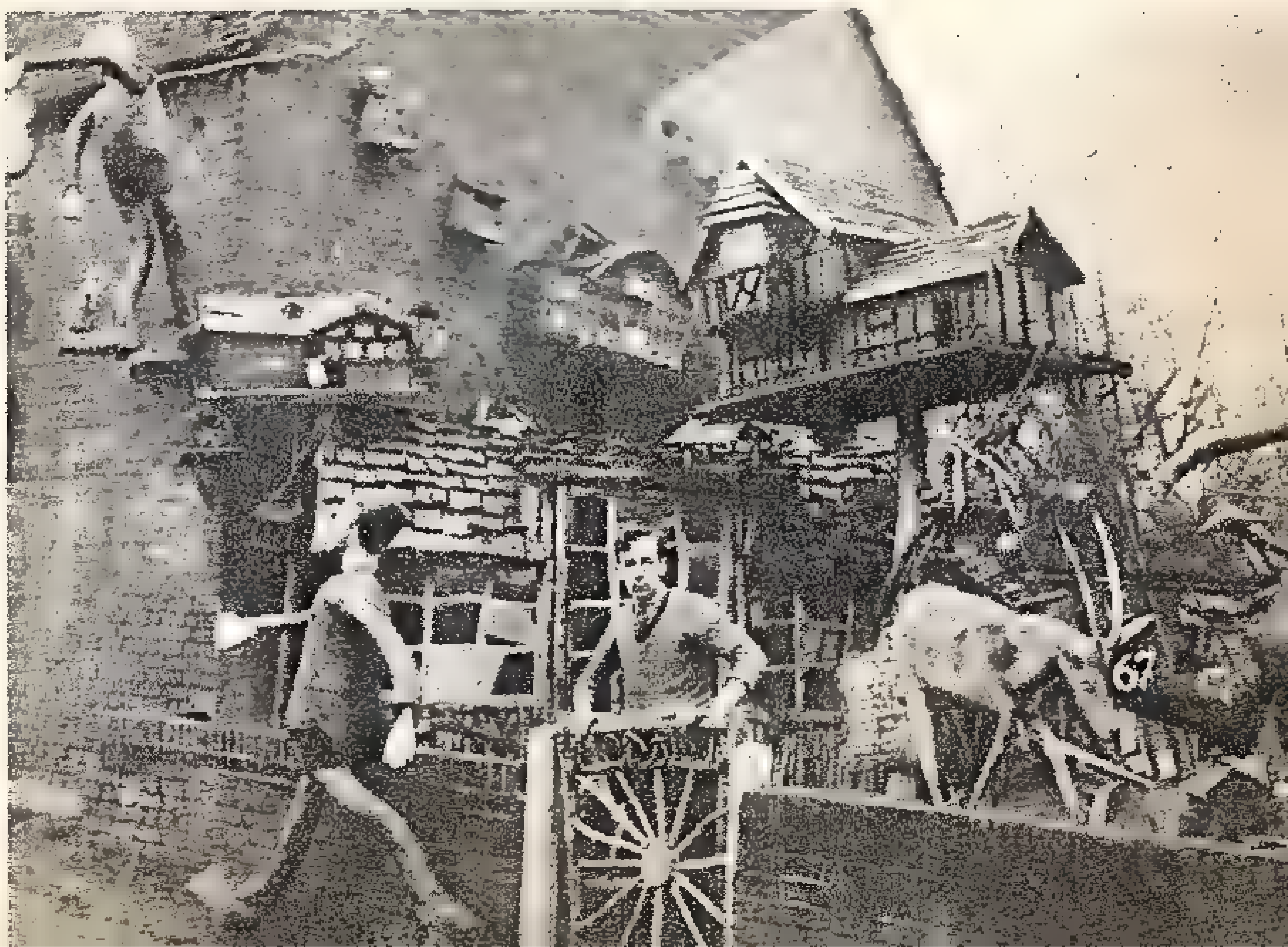
Plane Features Rapid Climb

POWERED by a twin-row radial engine of 1,200 horsepower, a new Seversky low-wing monoplane features a climbing speed of 4,000 feet per minute and a straightaway top speed of 340 m.p.h. The plane, known as the "Executive," is a commercial adaptation of the speed plane in which Frank Fuller, wealthy sportsman pilot, won the 1937 Bendix Trophy Race at the National Air Races in Cleveland, Ohio. The fuselage of the Executive plane is of monocoque, all-metal construction with an overall length of 14 feet and has a small two-seated cabin.

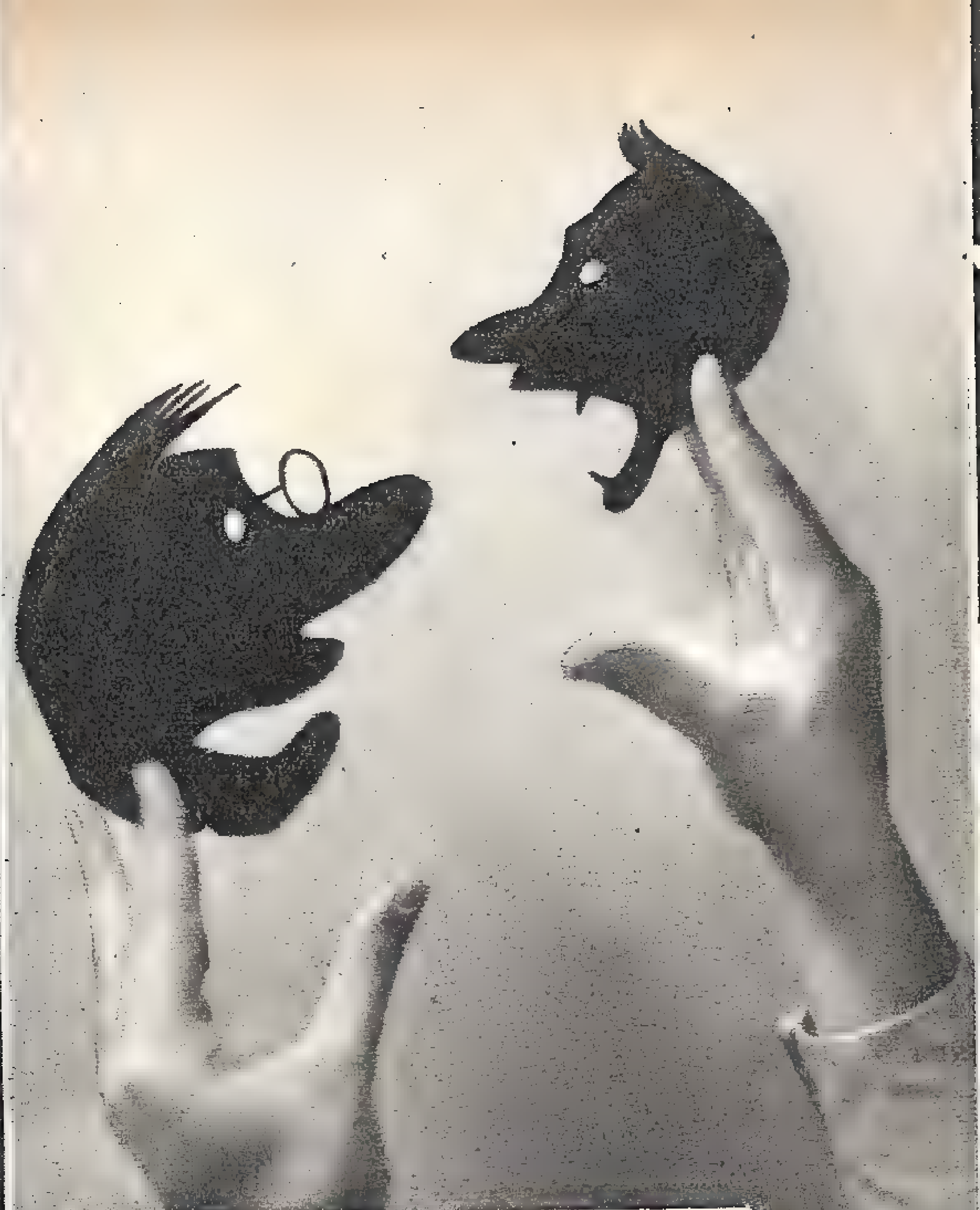
Carves Novel Tree Figures

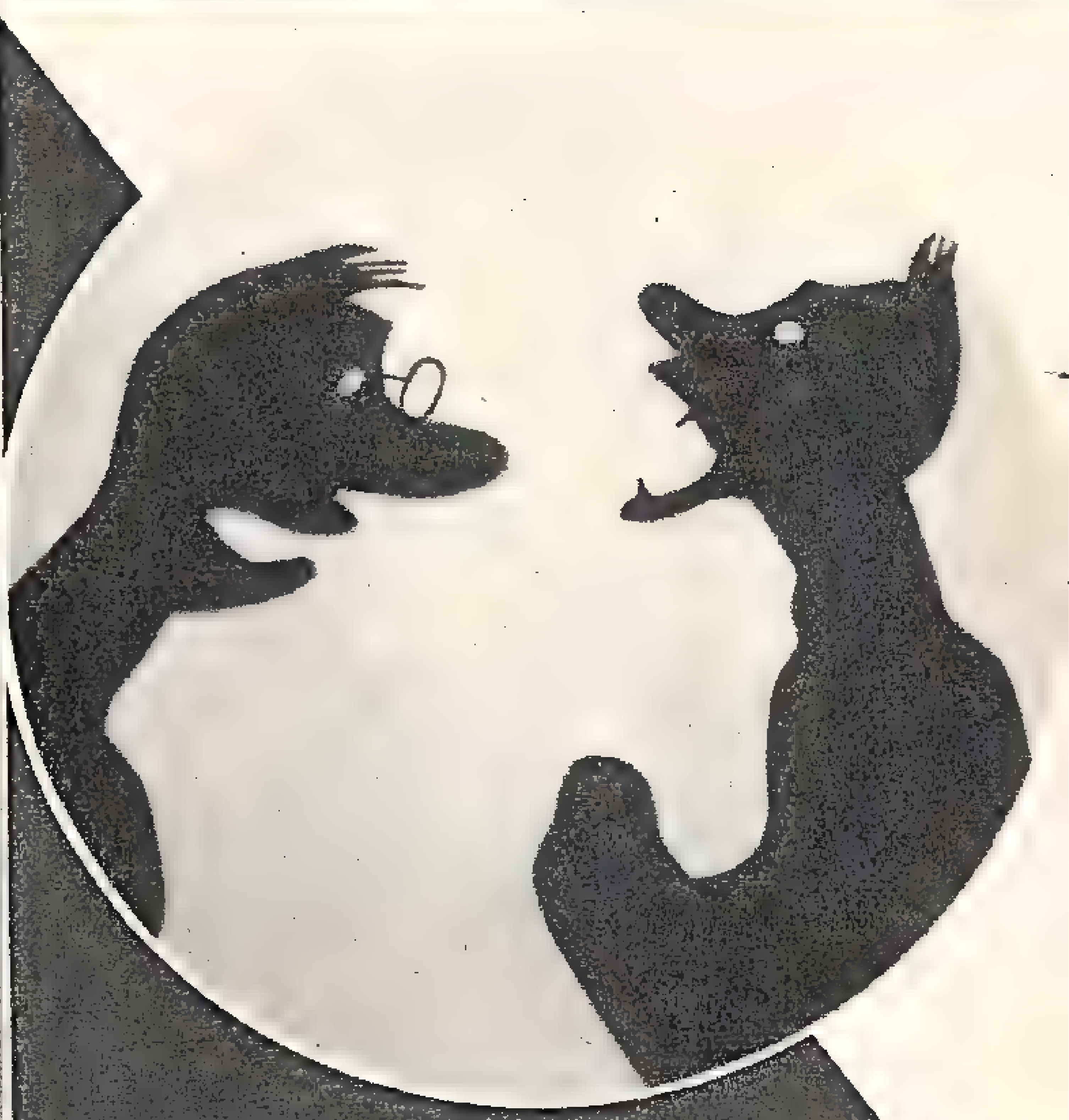
TRAVELERS passing through Woolmer Green in Herts, England, are attracted to the shop of Harry MacDonald, a young carpenter, by a display of all kinds of grotesque figures which he has carved out of tree trunks. The carved figures range from a few inches to several feet in size, the main attractions being figures of goats and human beings in various attitudes.

Harry MacDonald, a carpenter in Herts, England, attracts visitors to his shop with figures he carved from tree trunks.

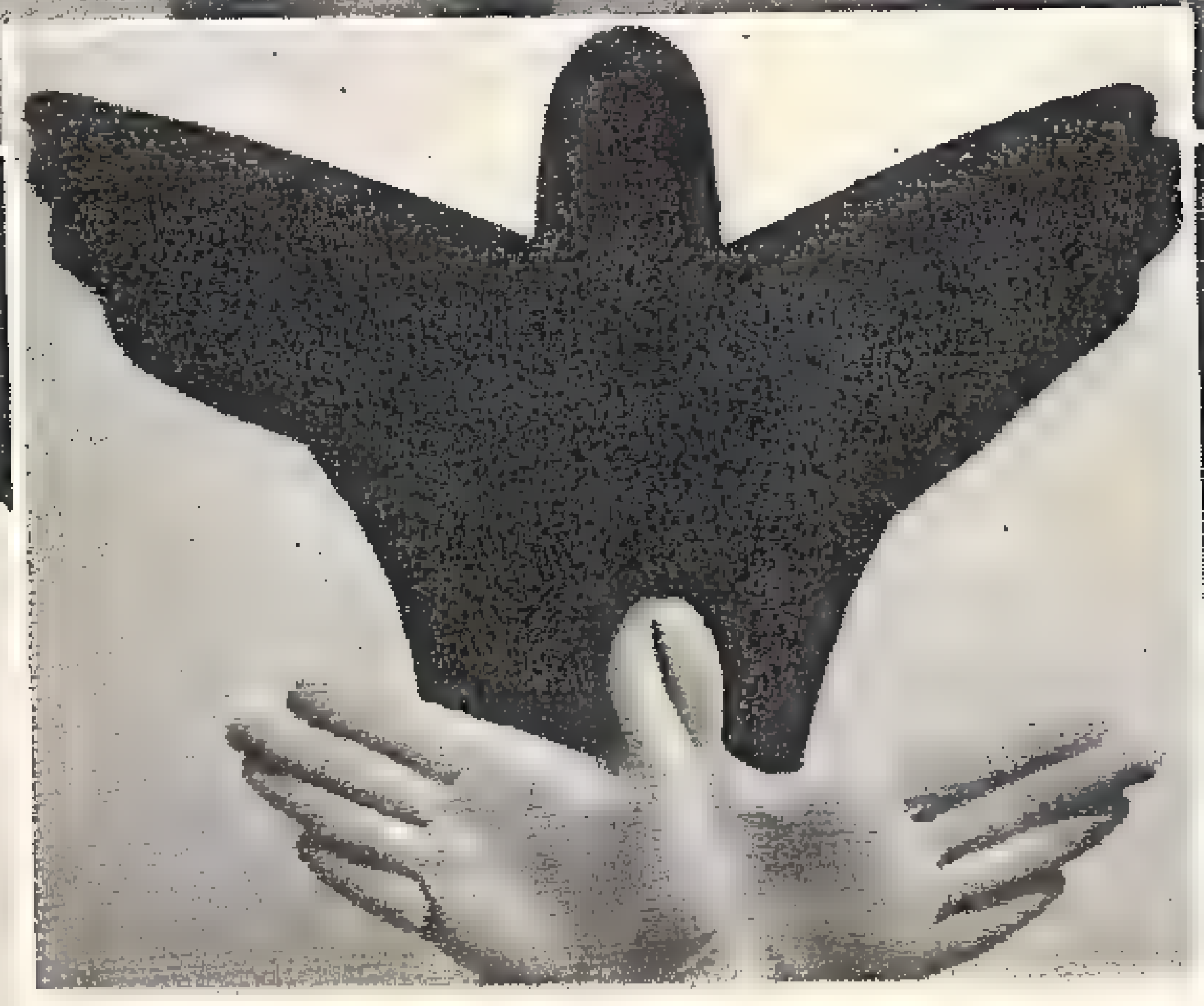


SHADOW AMUSEMENTS

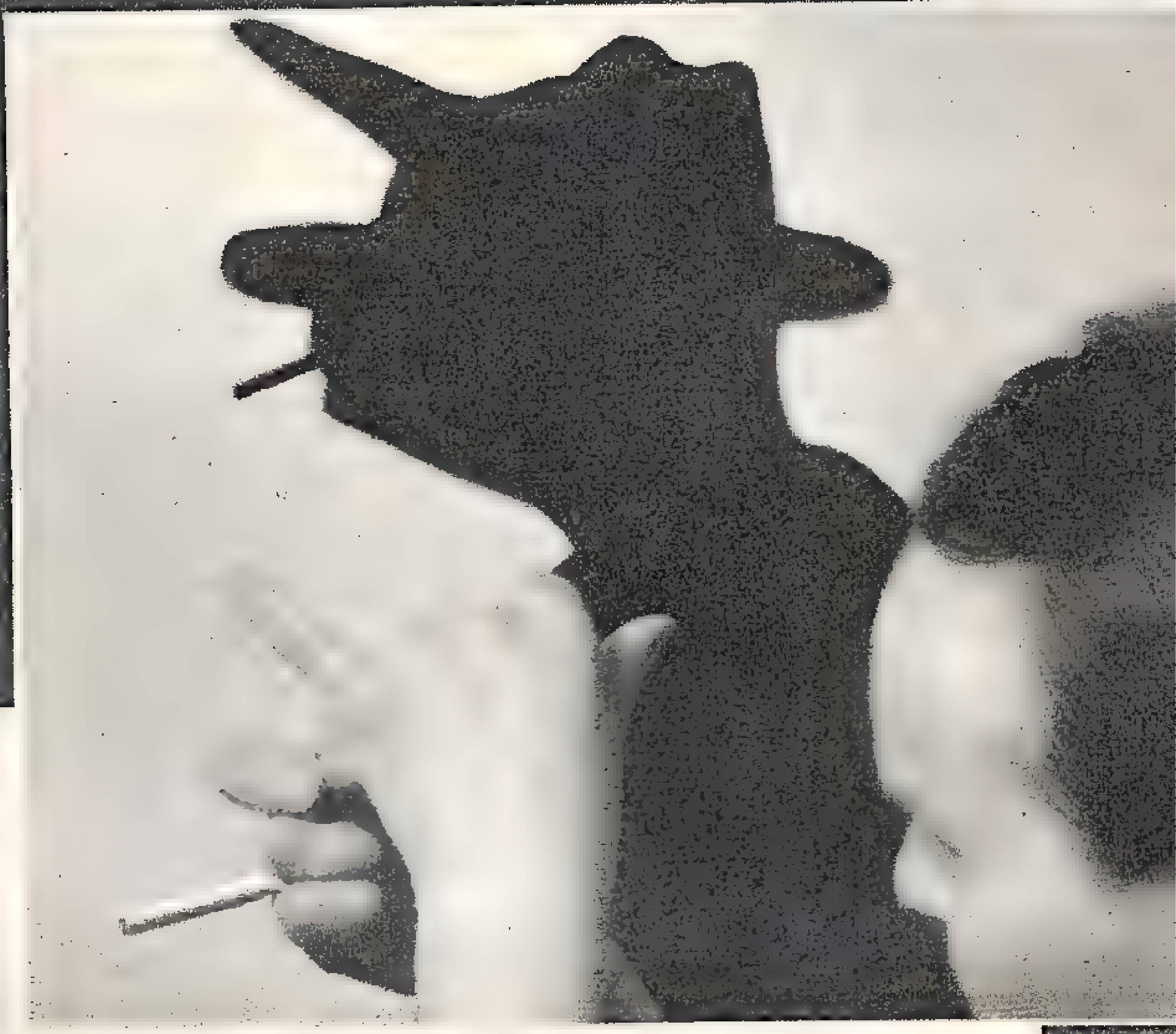




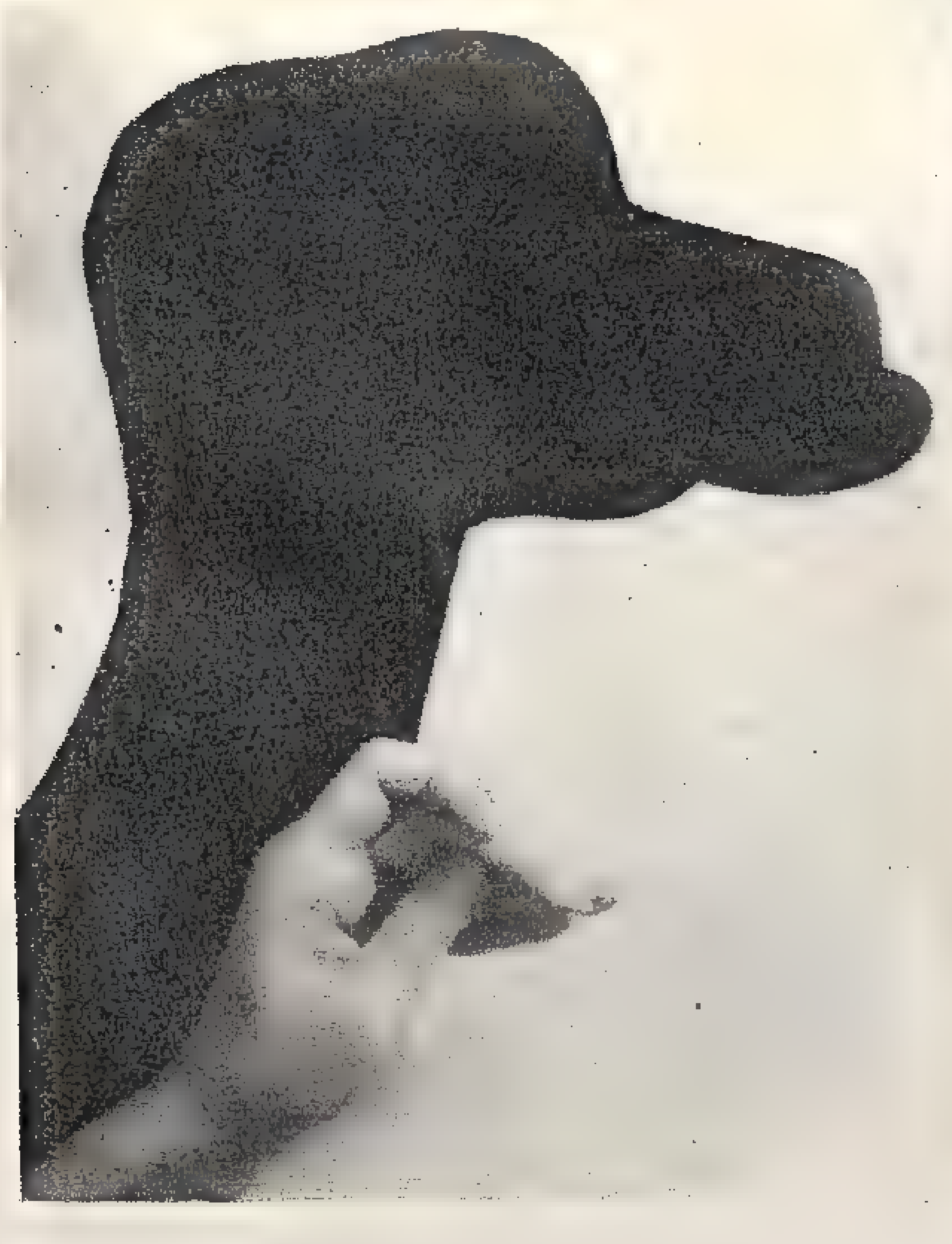
Many novel shadow pictures can be created through use of paper cut-outs. Shown at left is a set of cut-outs which, when held between a light and wall, produce the "Dentist and Patient" (above).



Interlocking the thumbs while holding palms open, as above, produces the simple shadow picture—"The Butterfly."



CHILDREN and grown-ups alike are intrigued by shadow pictures. Many house parties have been salvaged from the depths of boredom by the arrival of a guest who knew how to flick his fingers before a table lamp in such a manner as to cast mirth-provoking silhouettes upon the living room wall. Shown on this page are a few simple shadow pictures you can duplicate with a little practice. While a great many shadow pictures can be created through use of the hands alone, you will find that pipe cleaners, bent wire and other easily obtained "props" help to produce many startling and novel effects.

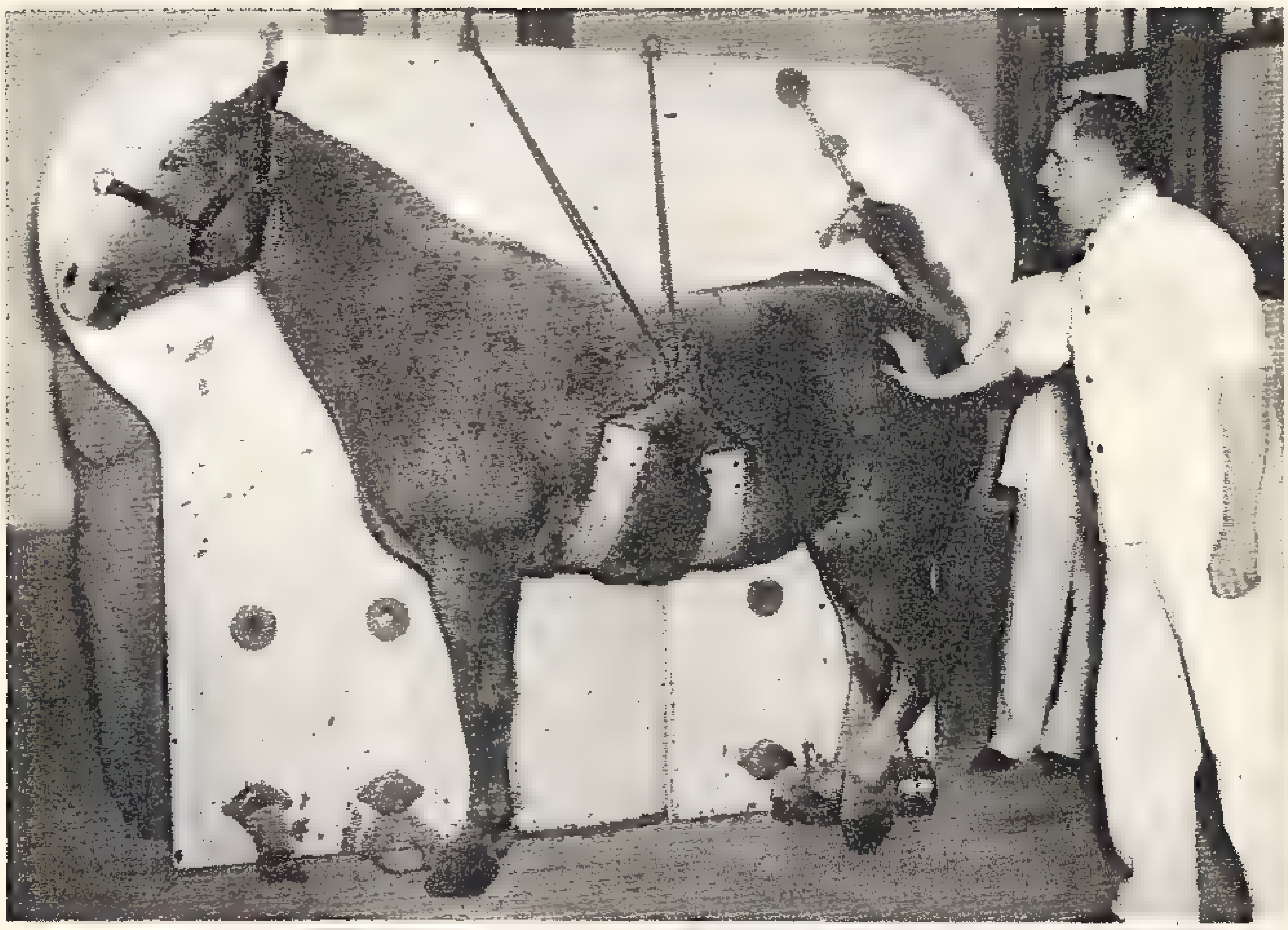


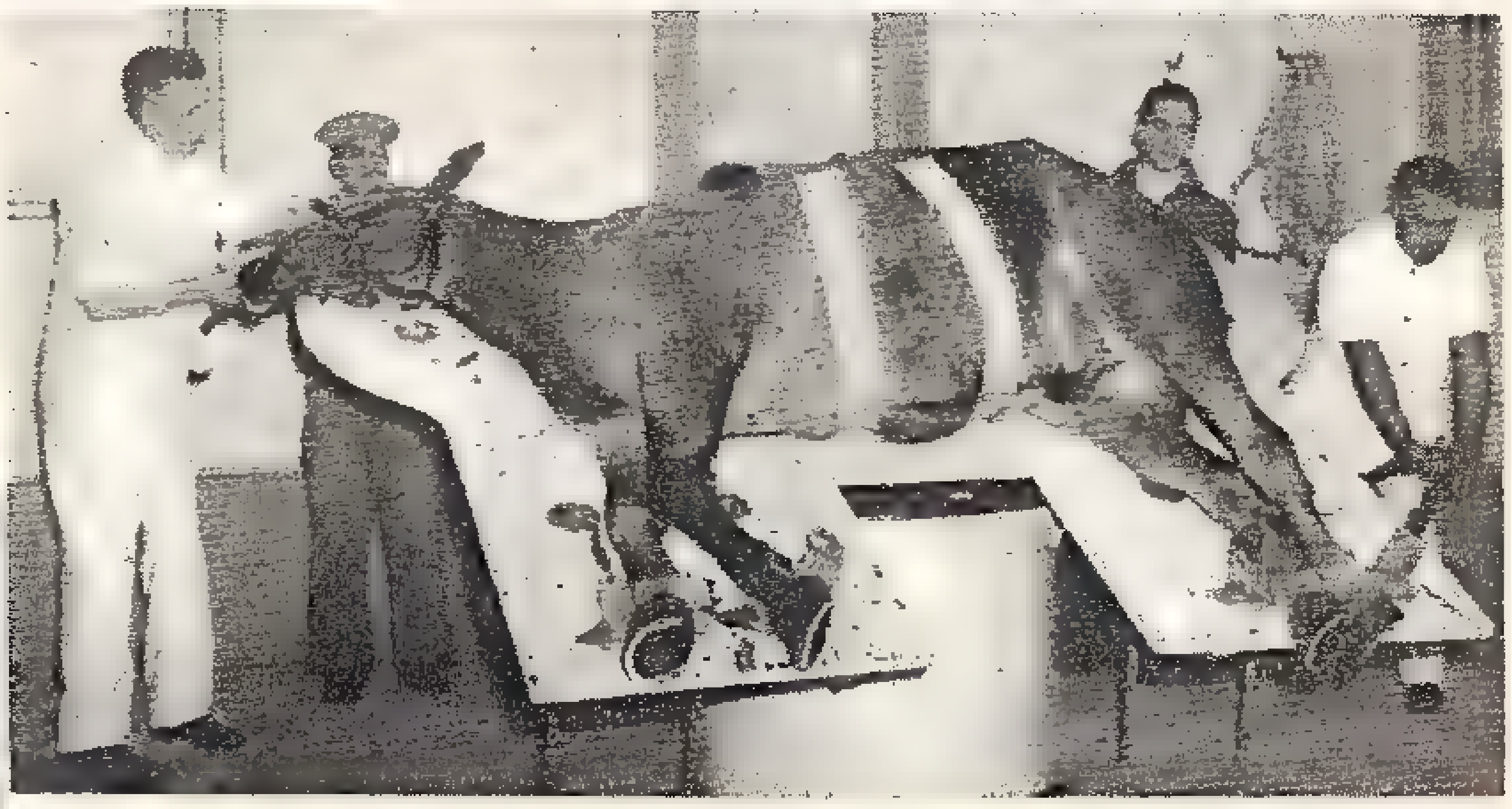
Another simple shadow picture is "The Camel," shown above. Somewhat more difficult to produce is the "Cigarette-Smoking Irishman," shown at lower right.

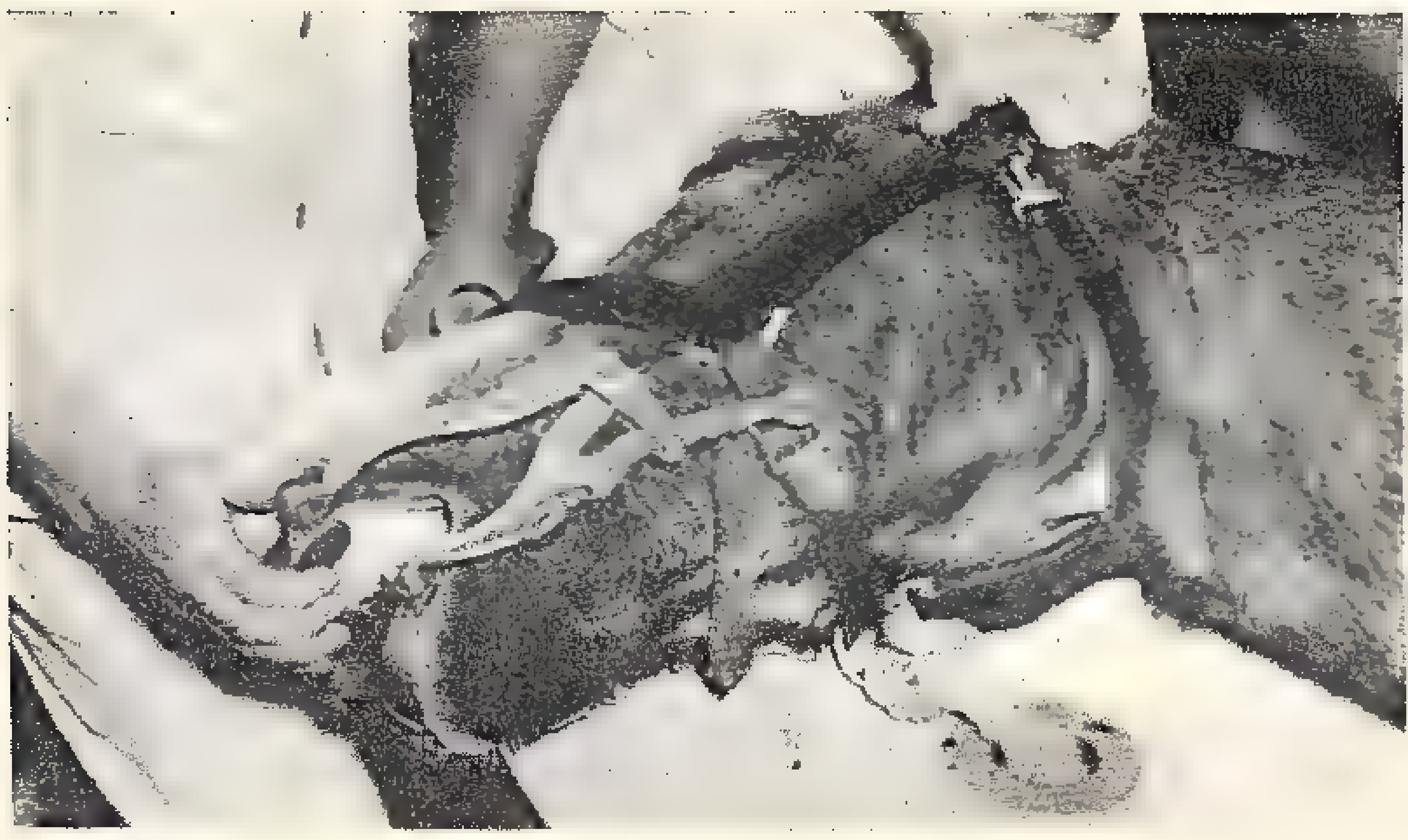
Tilting Table Aids Veterinarians' Horse Operations

DESIGNED specially to facilitate minor surgical operations and tooth extractions on horses, a huge "operating table" devised by veterinarians features a top that can be tilted at various angles so that the surgeons can have unrestricted access to the operating field. The horse's body is held rigidly in place atop the table by means of padded straps.

Prior to the operation, the horse is stood next to the table top, which is placed in a vertical position. A small dose of a general anesthetic is then administered while the padded table straps are placed gently around the animal's body. As the amount of anesthetic is increased, the horse sags, its body being supported entirely by the belly straps. Straps are then fastened around the horse's legs and head after which the table top is tilted to the desired operating position.





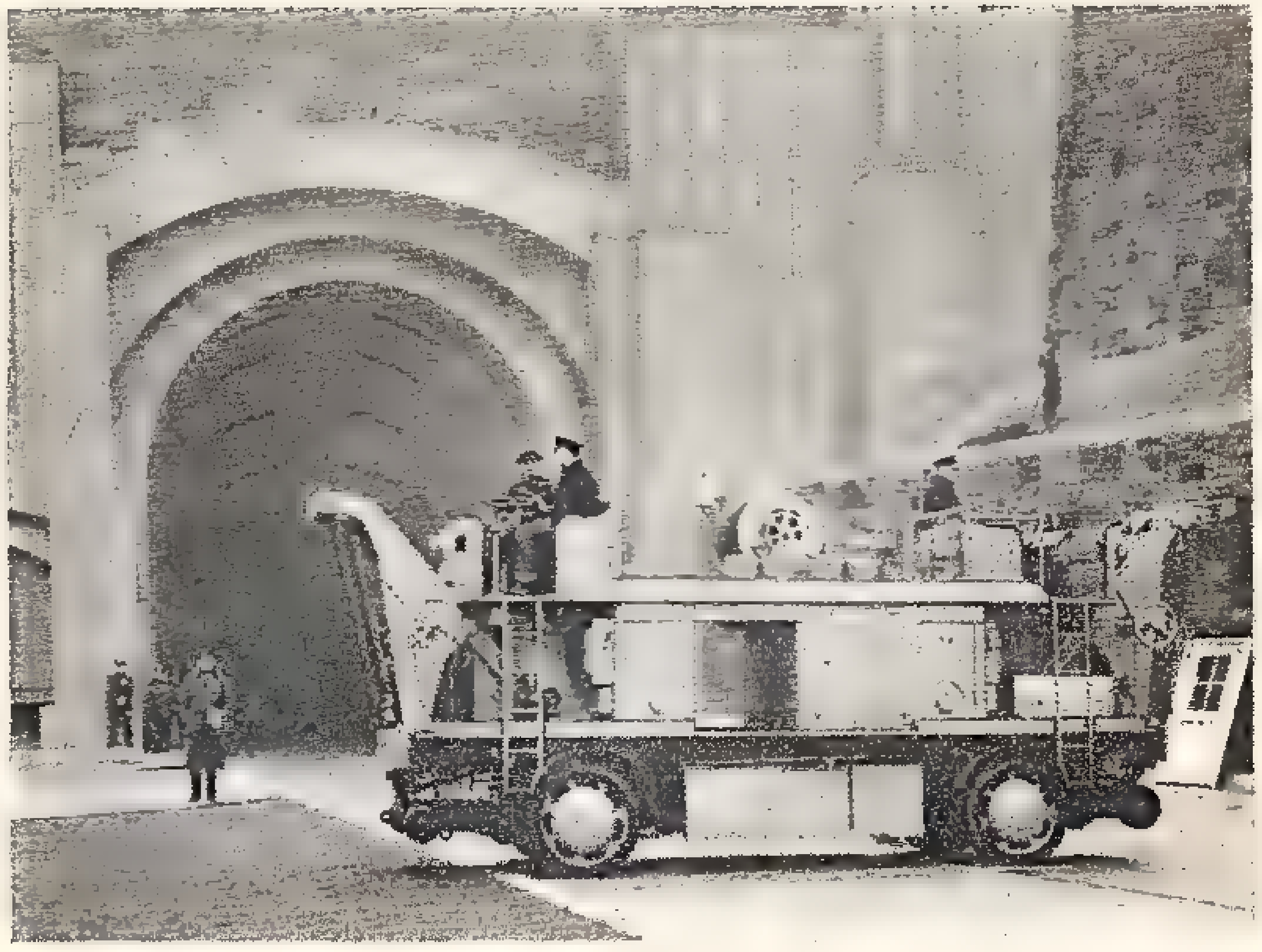


The photos above show how a horse is placed on the operating table by setting top in a vertical position while belly straps are adjusted, after which the top is tilted to any desired angle. Left—Clamps hold the anesthetized horse's jaws open for the operation while its head is held rigid by harness.

Lincoln Tunnel Equipped With Auto Salvage Trucks

FEATURING a capacity for traffic greater than that of the famous Holland Tunnel, the new Lincoln Tunnel, which also connects the states of New Jersey and New York, is equipped with the latest type of auto salvage trucks to meet any emergencies arising from autos crashing, stalling, or bursting in flame while en route through the tunnel.

The salvage trucks can be steered from either end, eliminating the necessity of turning around while in the tunnel. Each truck is equipped with fire hose, water buckets, chemical extinguishers and small cranes.



Standing at entrance of the new Lincoln Tunnel, which connects New York and New Jersey, passing under Hudson River, this well-equipped salvage truck is ready to aid distressed motorists.

A list of addresses of manufacturers of items mentioned in MODERN MECHANIX will be sent to any reader upon receipt of a stamped, return envelope.

THE FLOOD OF NEW STAMPS

"Type collecting" gives new opportunity to have a filled album at low cost.

by Montgomery Mulford

THE 1938 postage stamp catalog lists 2,018 *more* stamps than the edition of the previous year. The average number of new postage stamps appearing annually seems gradually to be mounting, thus creating a problem for the general collector.

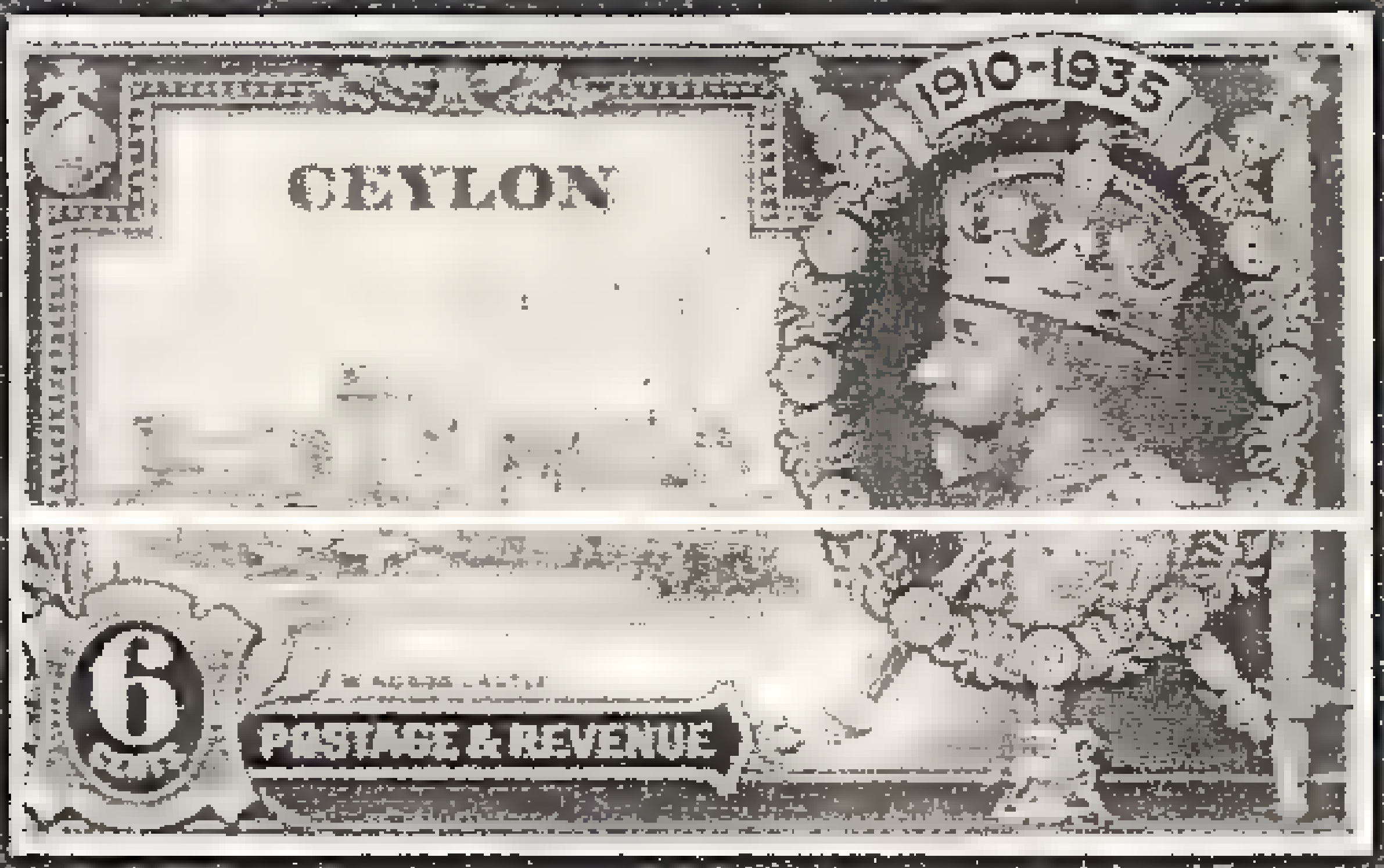
The solution is not always in specializing in any one country, or a group. There is still a host of general collectors who, it is admitted, are still the backbone of the hobby. Collectors still desire to save the postal papers of all the world, and yet they are faced with a veritable deluge of issues. The Spanish civil war alone has resulted in as many as a hundred and fifty new stamps!

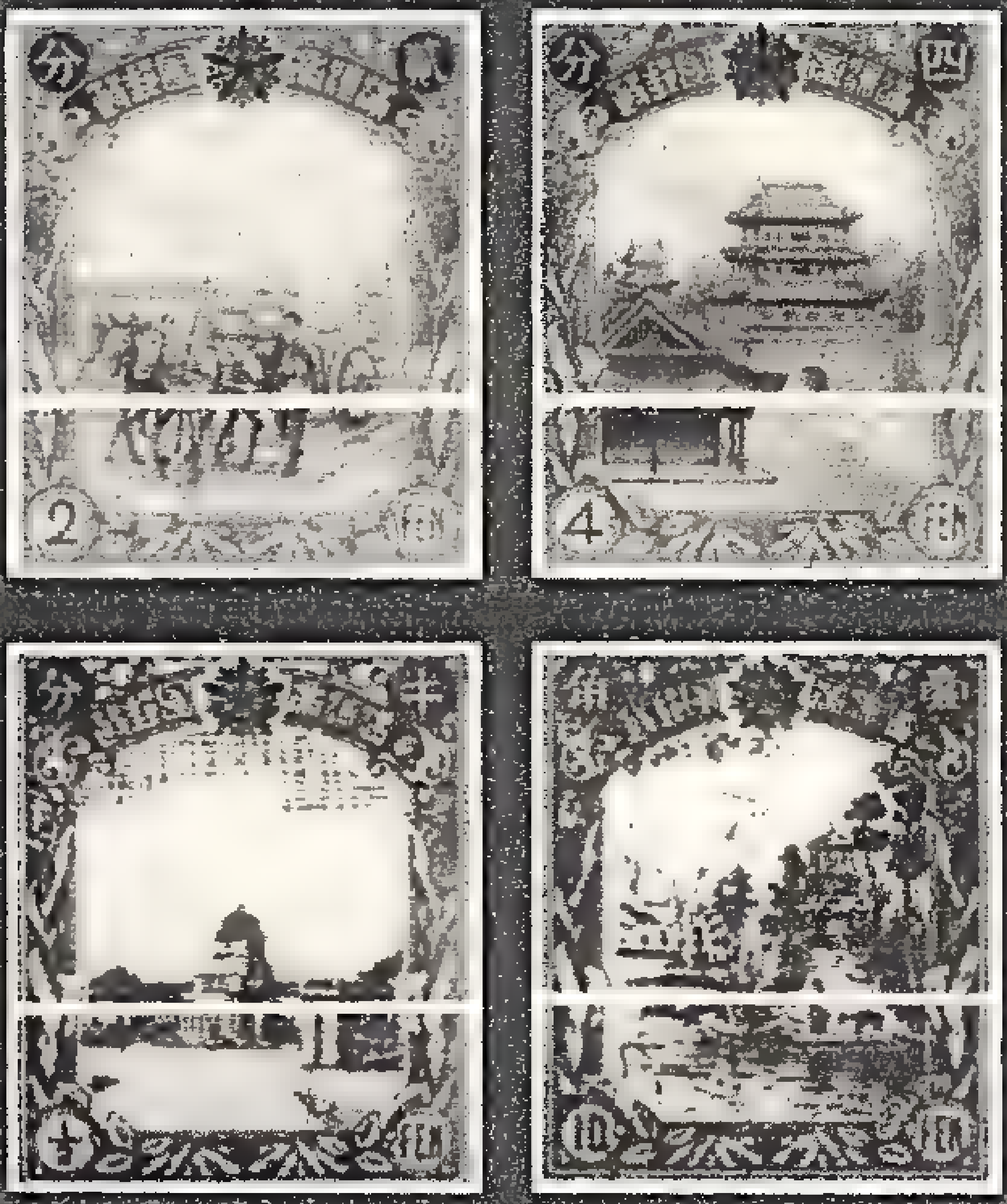
When a collector is enthusiastic about all the stamps of the world, he should never attempt to turn from them and force himself to collect some special field. He should always collect what he desires; otherwise interest will wane. And so he may continue to collect stamps of the world, mounting every type, and yet not be forced to collect every stamp-value!

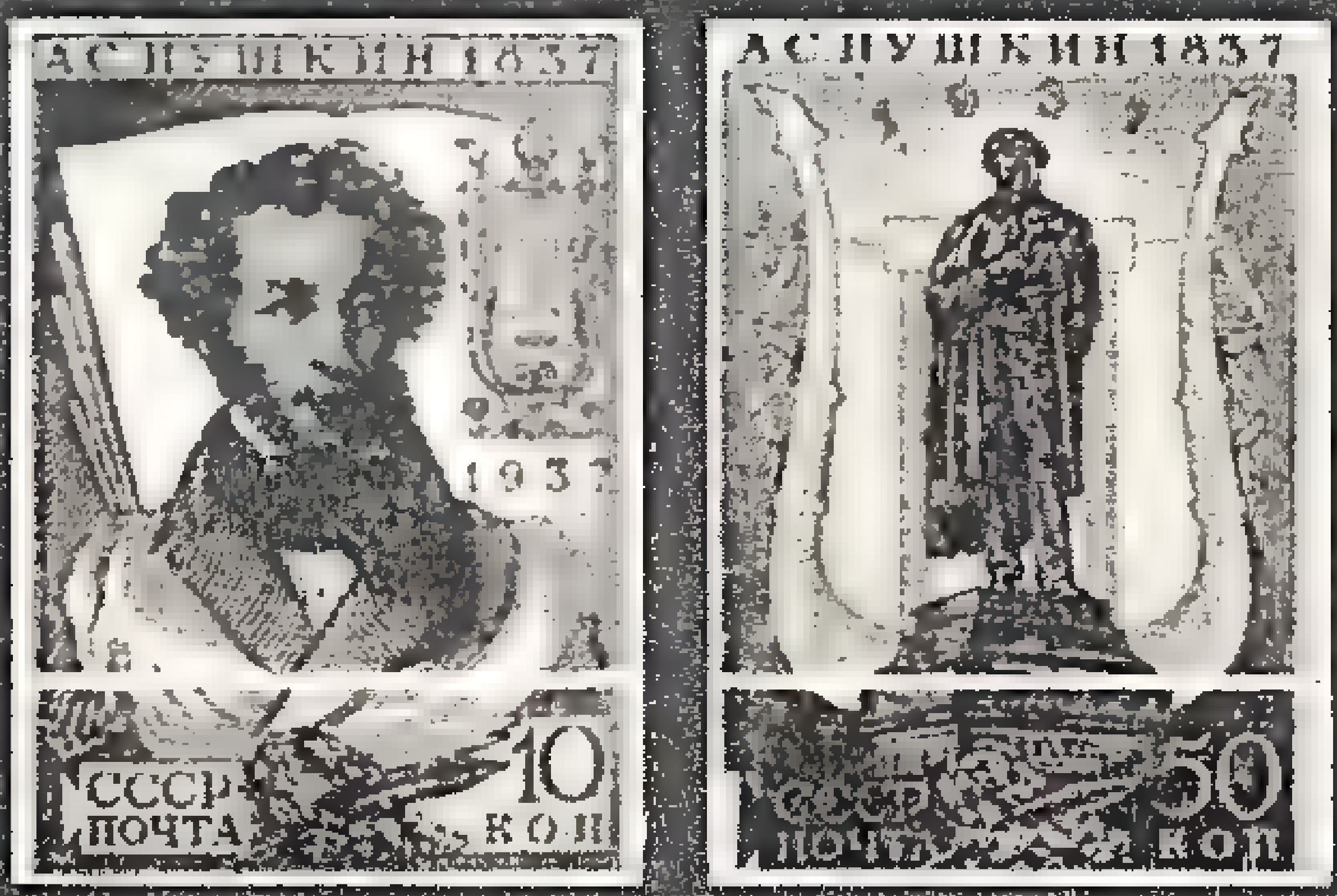
The answer, to be outlined, is in the "Type Collection." This sort of collecting is one in which the collector saves every type, and not every issue. For instance: an issue from some country may appear, all the values bearing the same design. Canada, in 1937 issued postage stamps, three in number, portraying George VI. All three of the values—one, two, three cents—show the same likeness. The "type collector," therefore, is not faced with the necessity of collecting all three; merely one of these stamps. He has one stamp to show the type of that issue, without all the values.

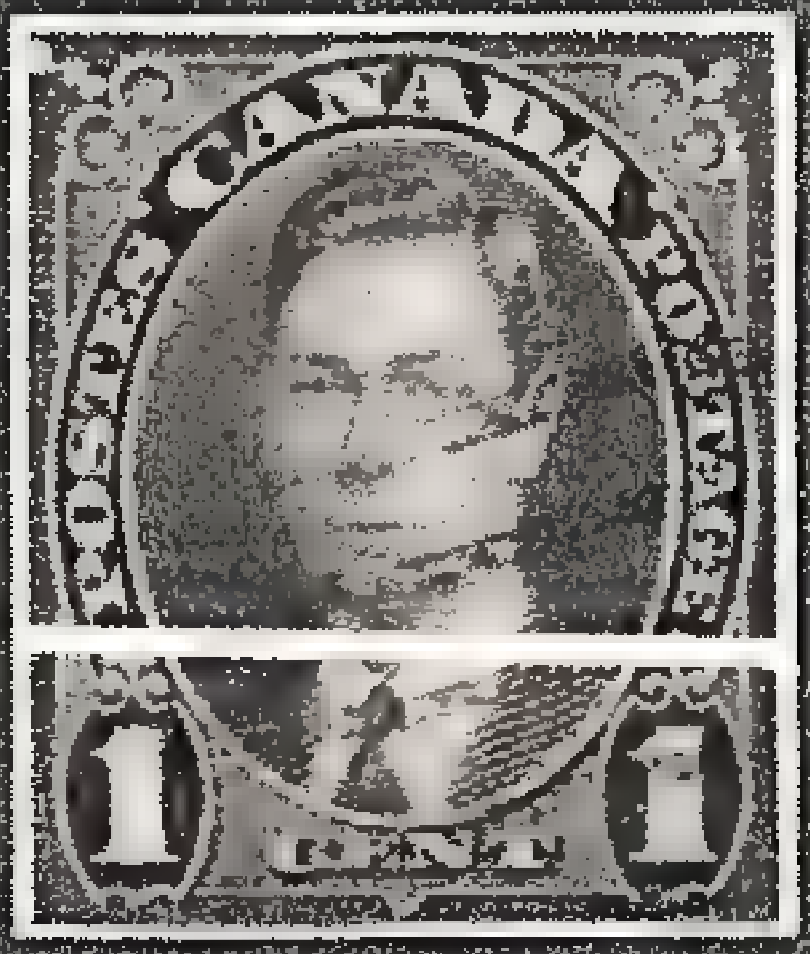
If an issue appears, again, showing two types—two different designs that is to say—although more than two stamps appear in the series, he need collect only two stamps of the issue. For example, Russia in

[*Continued on page* 132]







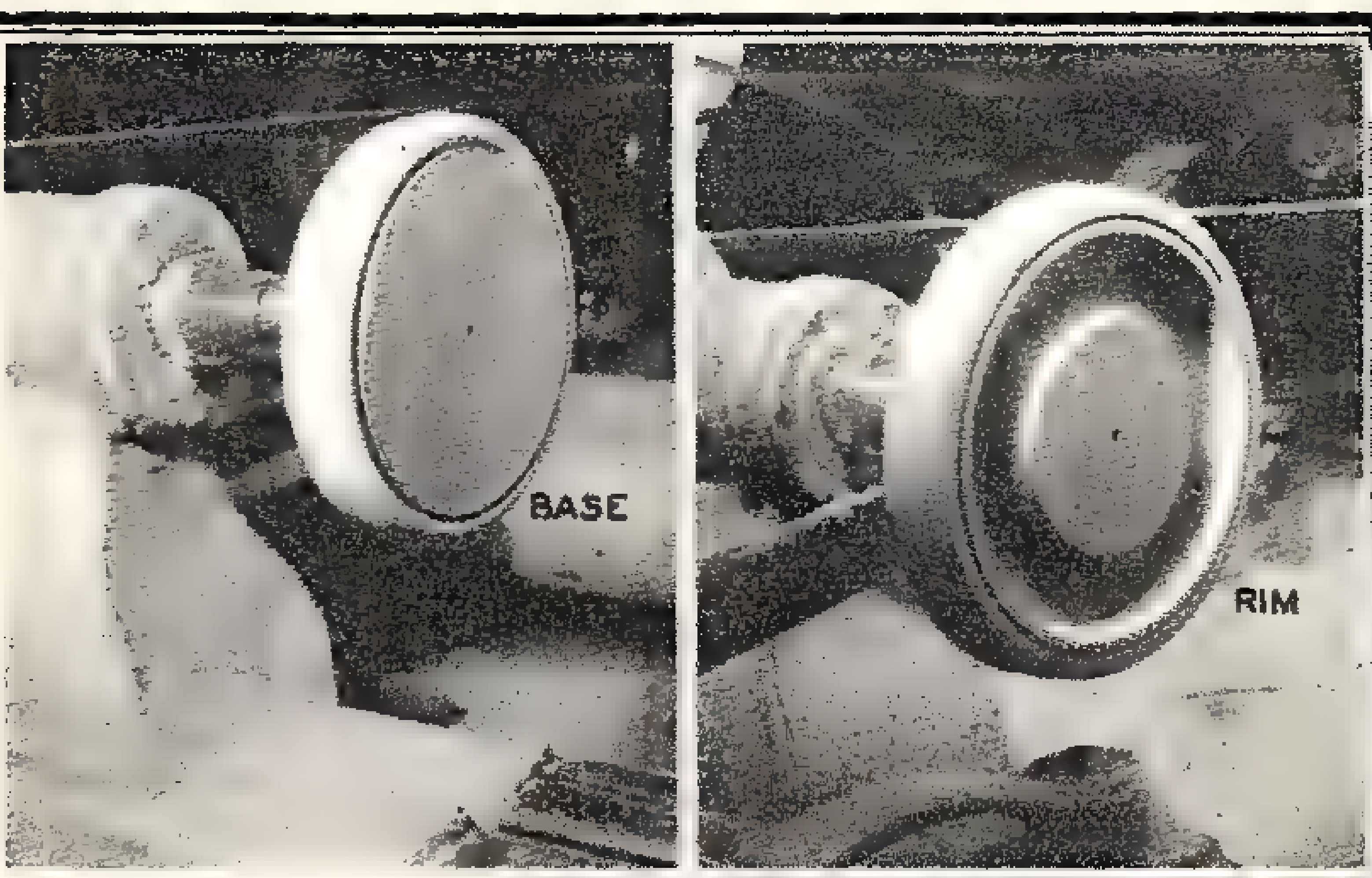


CRAFTS and HOBBIES

FLOWER POT SHELL

A Scrap Wood Project

by Dale Van Horn



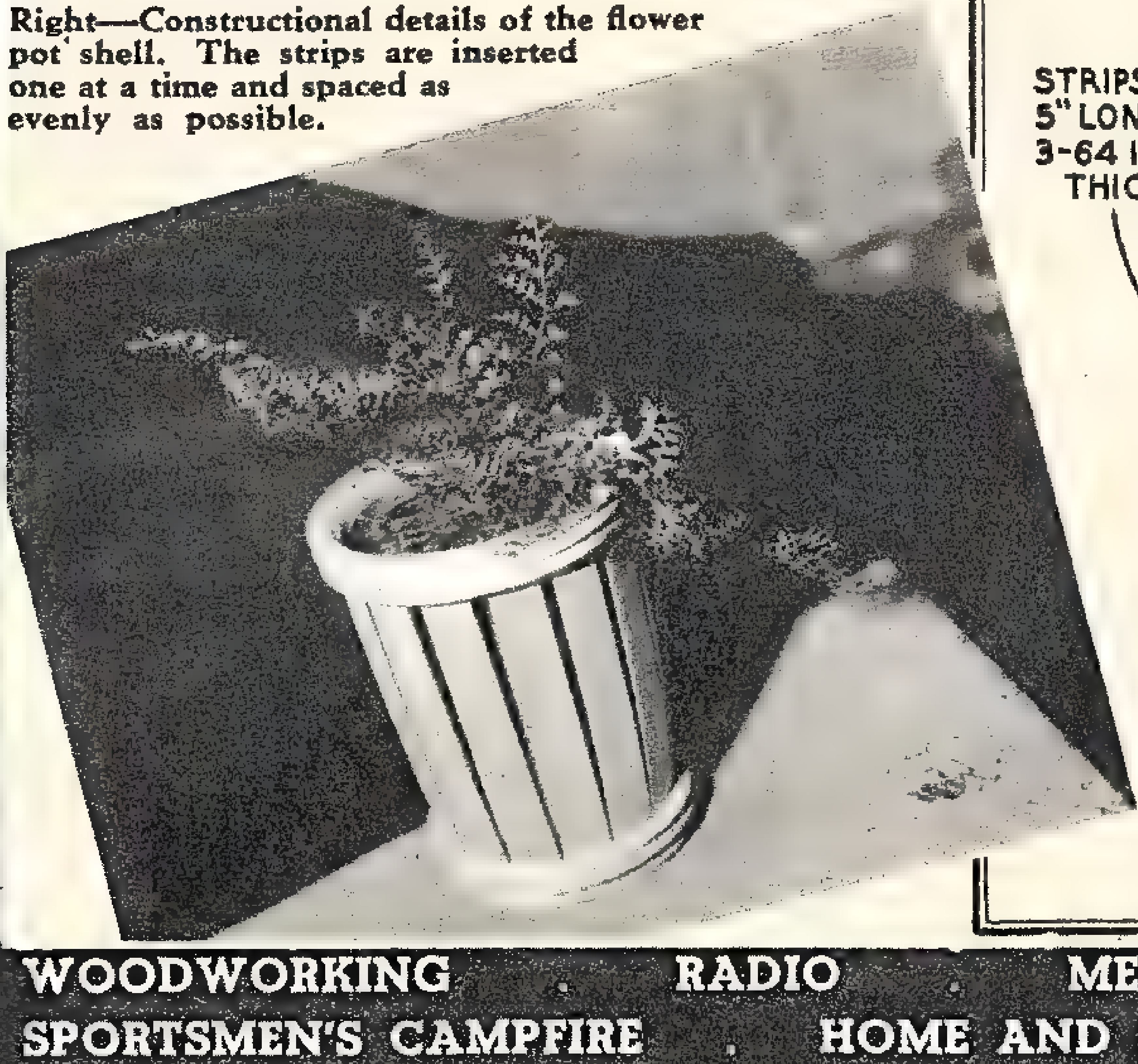
Above — The rim and base during the turning process. Right—Side strips are 3/64" thick.

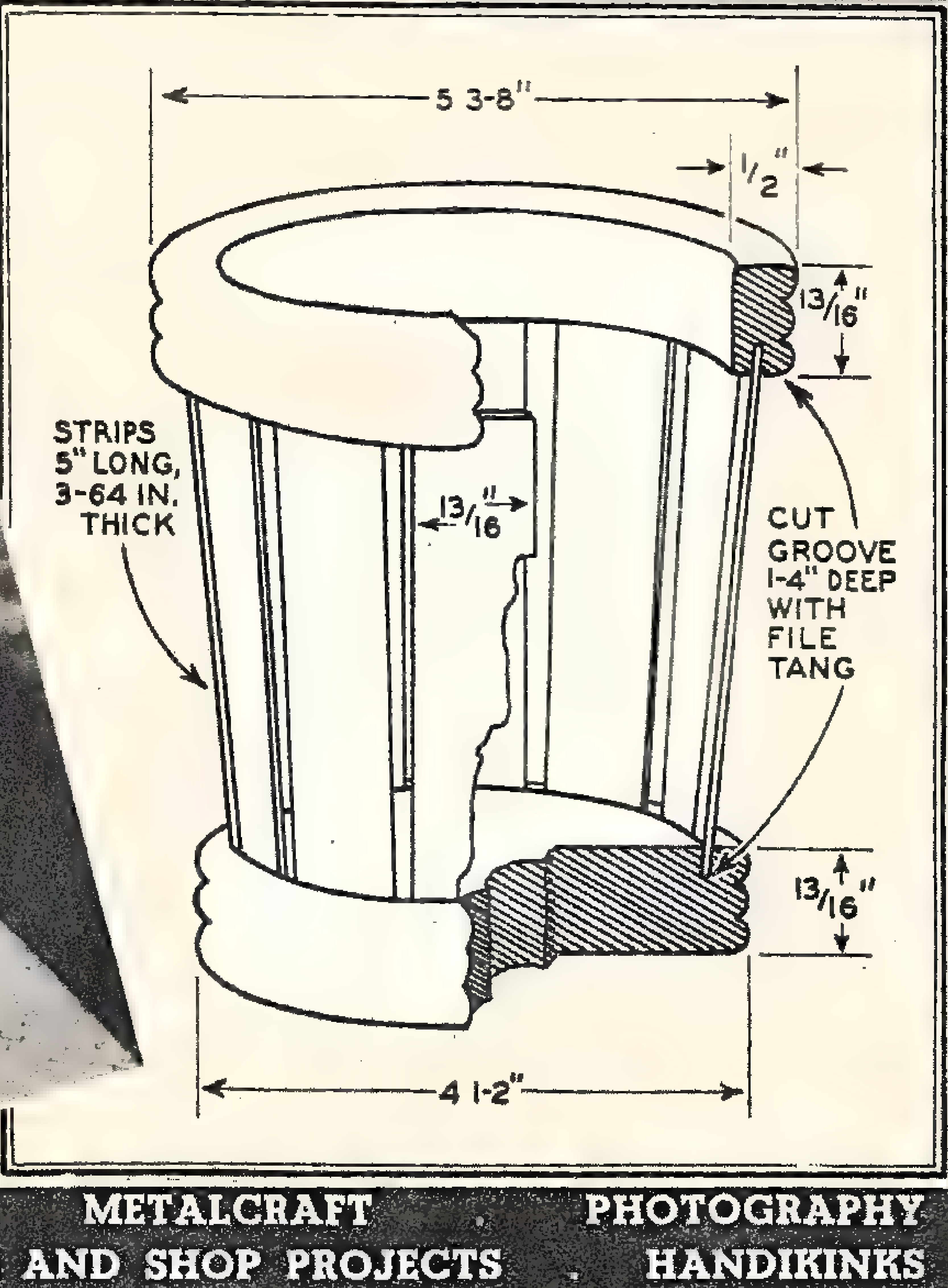
THIS project requires a piece of white pine 11 inches long, 8 inches wide and $\frac{13}{16}$-inch thick. Scribe two circles, 5½ and 4¾ inches in diameter, as near one edge as possible and saw them out. From the waste, rip the 13 pieces 3/64ths of an inch thick and 5 inches long. If you have one of the new, larger band saws and a rather wide blade you will find that ripping the strips with it will be better than using the bench saw because of less waste and a smoother cut.

Turn the bottom to the dimensions shown, making the lower groove with a sharpened file tang. Sand smooth and then rub with fine steel wool. Cut the top ring in the same manner, shaping the edge first, then cutting half way through from one side and later completing the

[*Continued on page* 120]

Right—Constructional details of the flower pot shell. The strips are inserted one at a time and spaced as evenly as possible.




5 3-8"
1/2"
13/16"
STRIPS 5" LONG, 3-64 IN. THICK
13/16"
CUT GROOVE 1-4" DEEP WITH FILE TANG
13/16"
4 1-2"

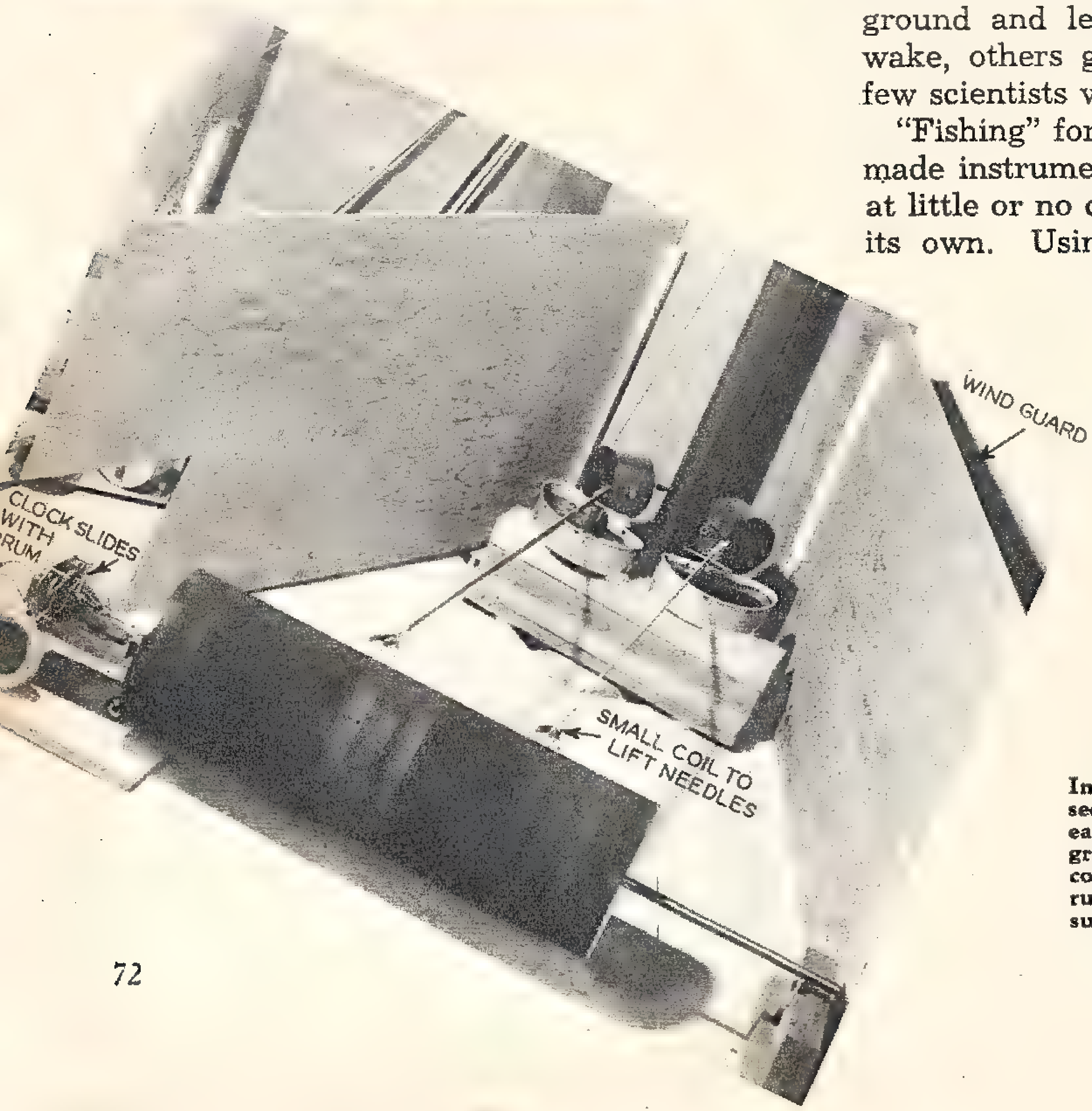
FISHING for DISTANT EARTHQUAKES with a

Designed for the amateur scientist, this easily-built instrument records earth tremors occurring in all parts of world.

by Don Murphy

EVERY few minutes, an earthquake vibrates through old Earth's rocky crust. On an average, more than 9,000 of these shocks occur every year—some of them sending buildings crashing to the ground and leaving ruined cities in their wake, others going unnoticed except by a few scientists who specialize in this subject.

"Fishing" for these tremors with a home-made instrument, built from odds and ends at little or no cost, is a sport with thrills all its own. Using an instrument similar to that described below, Martin G. Murray, its designer, bagged complete records of the disastrous March, 1933, earthquake that devastated a whole section of southern California. So good were his 'grams that seismologists of nationally known observatories were glad to exchange records with



In the picture above, Martin G. Murray is seen examing a seismogram made on his earthquake recorder. A close-up of seismograph appears at left. Note that it incorporates such special refinements as a rubber tired drum carriage and vanes submerged in oil to dampen vibrations.

Electric magnets attached to the recording arms of the seismograph are automatically raised each hour to provide a time check on the record itself. A sweep second electric clock, with face removed, is provided with electric contacts that close magnetic circuit.

home-made seismograph

him from their big, complicated machines costing hundreds of dollars.

A seismograph is nothing but a large pendulum with a pointer which scratches a fine line on a revolving drum. Strangely, when a quake comes, it moves the drum itself —*not* the pendulum, which swings freely and whose inertia keeps it at rest, while the ground and everything attached rigidly to it quivers and shakes. The vibration of the earth is greatly magnified by a long arm attached to the pendulum bob, so that the record may be more easily studied. Simply by changing the length of the pendulum, the machine may be "tuned" to far-away quakes much as a piano is set to a tuning fork.

To build a simple, yet effective, seismograph, first cut a triangular piece of scrap plate ⅜ or ½-inch thick and 18 to 20 inches on the side, as shown in Fig. 1. Your local blacksmith will help you out on this for a small charge. Drill a ½-inch hole through the plate near each corner and weld a 42-inch piece of 2-inch angle iron, vertically, in the center of it.

Near the top of the angle iron, drill a ¼-inch hole through each face and fasten a ¼ by 1½-inch bolt.

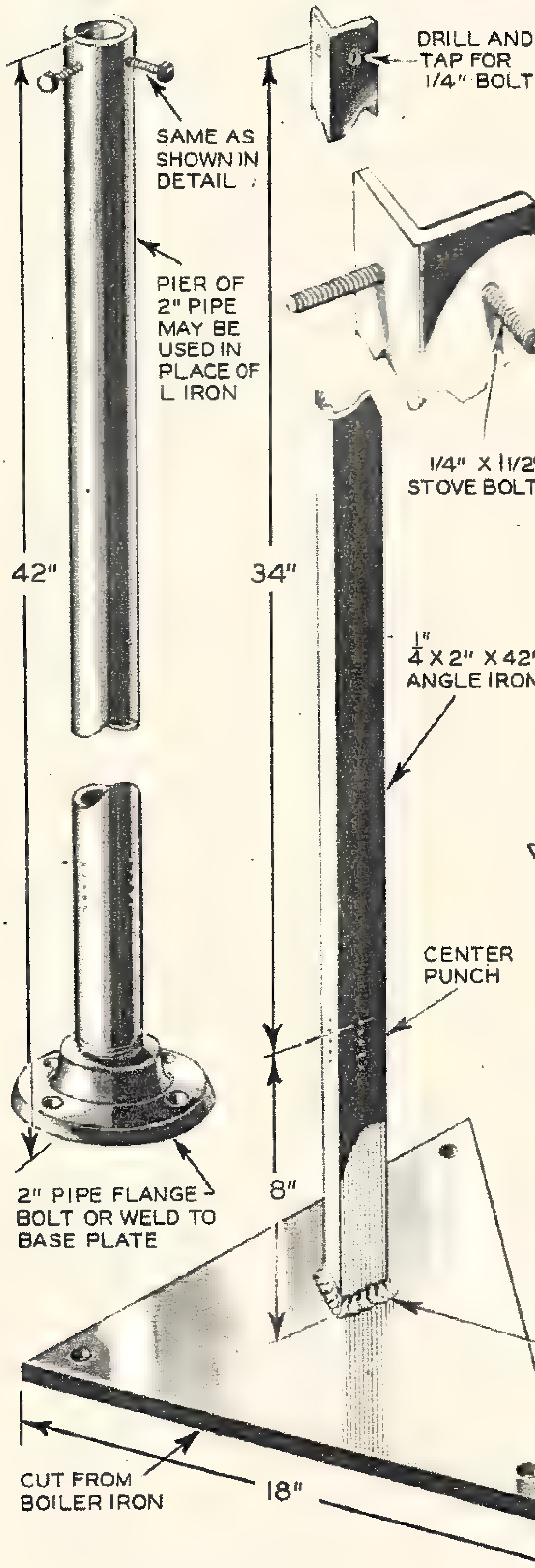

DRILL AND TAP FOR 1/4" BOLT
SAME AS SHOWN IN DETAIL
PIER OF 2" PIPE MAY BE USED IN PLACE OF L IRON
1/4" X 1 1/2" STOVE BOLT
42"
34"
1/4" X 2" X 42" ANGLE IRON
CENTER PUNCH
8"
2" PIPE FLANGE BOLT OR WELD TO BASE PLATE
WELD
CUT FROM BOILER IRON
18"
DRILL FOR 1/2" BOLT

FIG.I DETAILS OF THE PIER & BASE PLATE

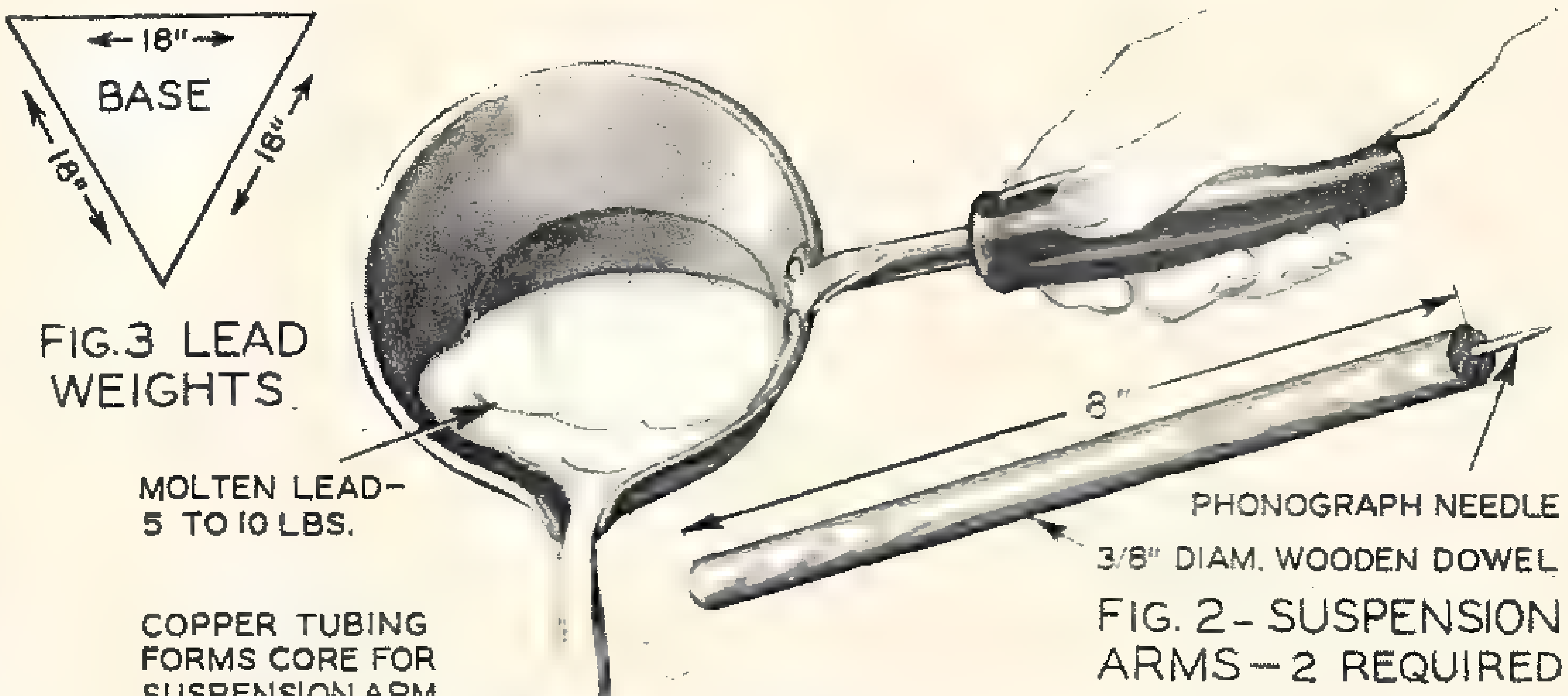
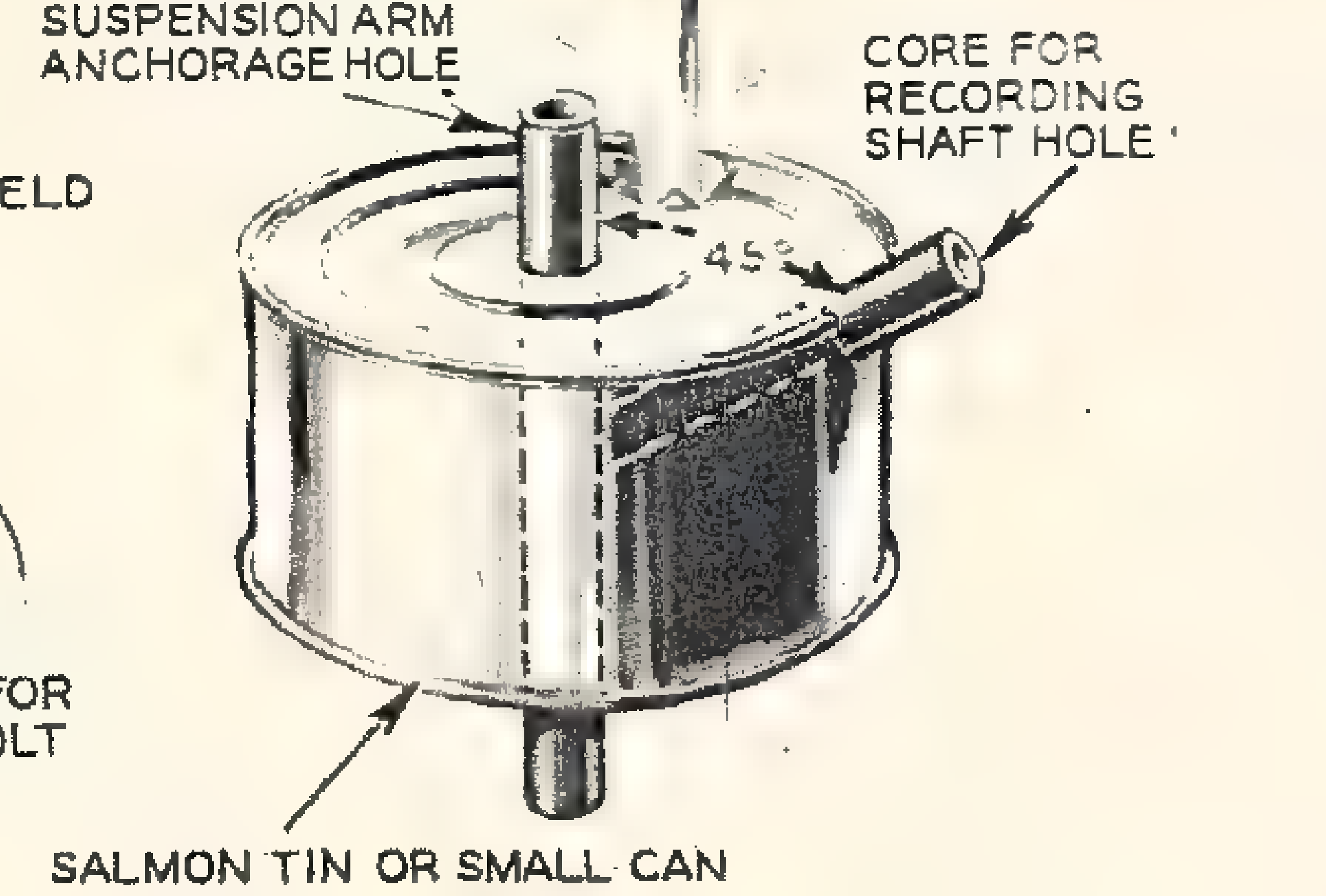
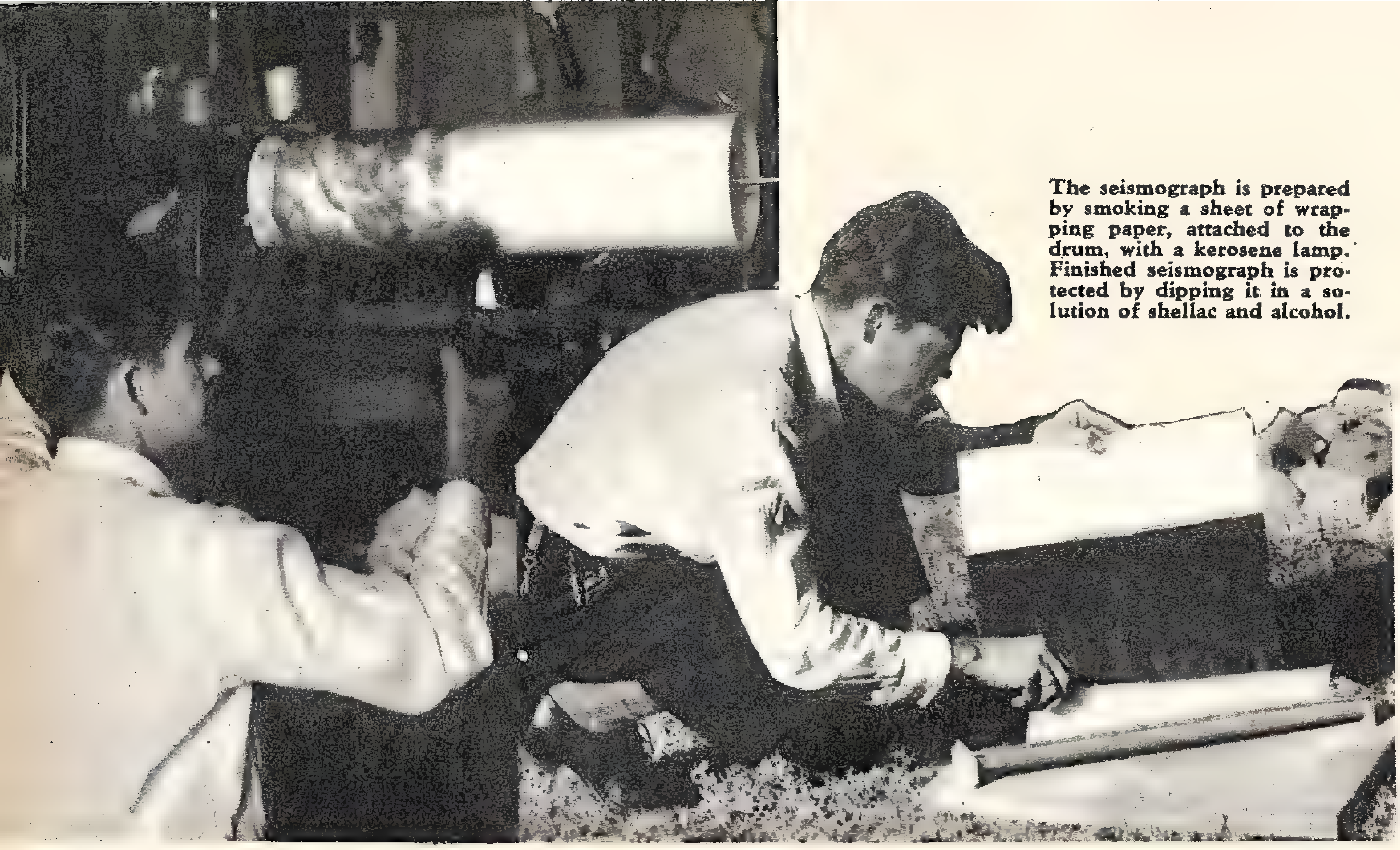

18"
BASE
18"
18"
MOLTEN LEAD— 5 TO 10 LBS.
8"
PHONOGRAPH NEEDLE
3/8" DIAM. WOODEN DOWEL
COPPER TUBING FORMS CORE FOR SUSPENSION ARM ANCHORAGE HOLE

FIG.3 LEAD WEIGHTS

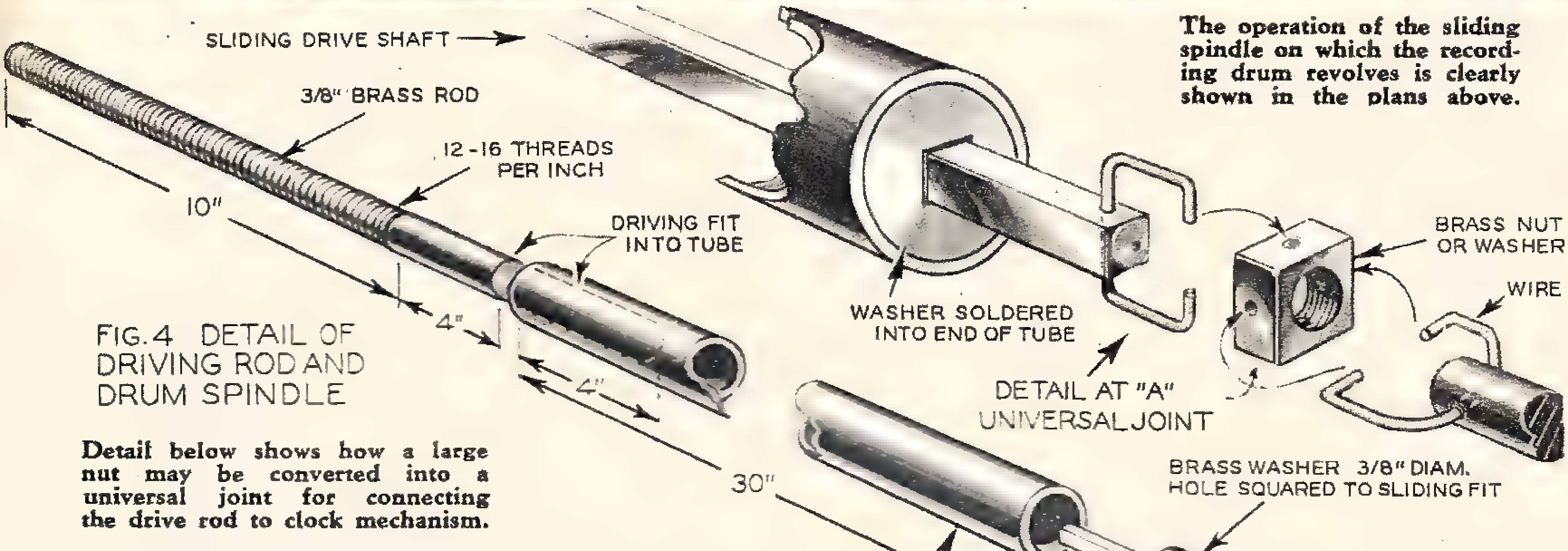
FIG. 2 - SUSPENSION ARMS — 2 REQUIRED


CORE FOR RECORDING SHAFT HOLE
45°
SALMON TIN OR SMALL CAN

Details at left show the pier suggested by the designer as well as a simpler pipe column which may be substituted. Fig. 3 shows the method used in casting lead pendulum weights. Small tin cans serve as molds for molten metal.



The seismograph is prepared by smoking a sheet of wrapping paper, attached to the drum, with a kerosene lamp. Finished seismograph is protected by dipping it in a solution of shellac and alcohol.


SLIDING DRIVE SHAFT
3/8" BRASS ROD
12-16 THREADS PER INCH
10"
4"
4"
30"
DRIVING FIT INTO TUBE
WASHER SOLDERED INTO END OF TUBE
DETAIL AT "A" UNIVERSAL JOINT
BRASS NUT OR WASHER
WIRE
BRASS WASHER 3/8" DIAM. HOLE SQUARED TO SLIDING FIT

The operation of the sliding spindle on which the recording drum revolves is clearly shown in the plans above.

FIG. 4 DETAIL OF DRIVING ROD AND DRUM SPINDLE

Detail below shows how a large nut may be converted into a universal joint for connecting the drive rod to clock mechanism.

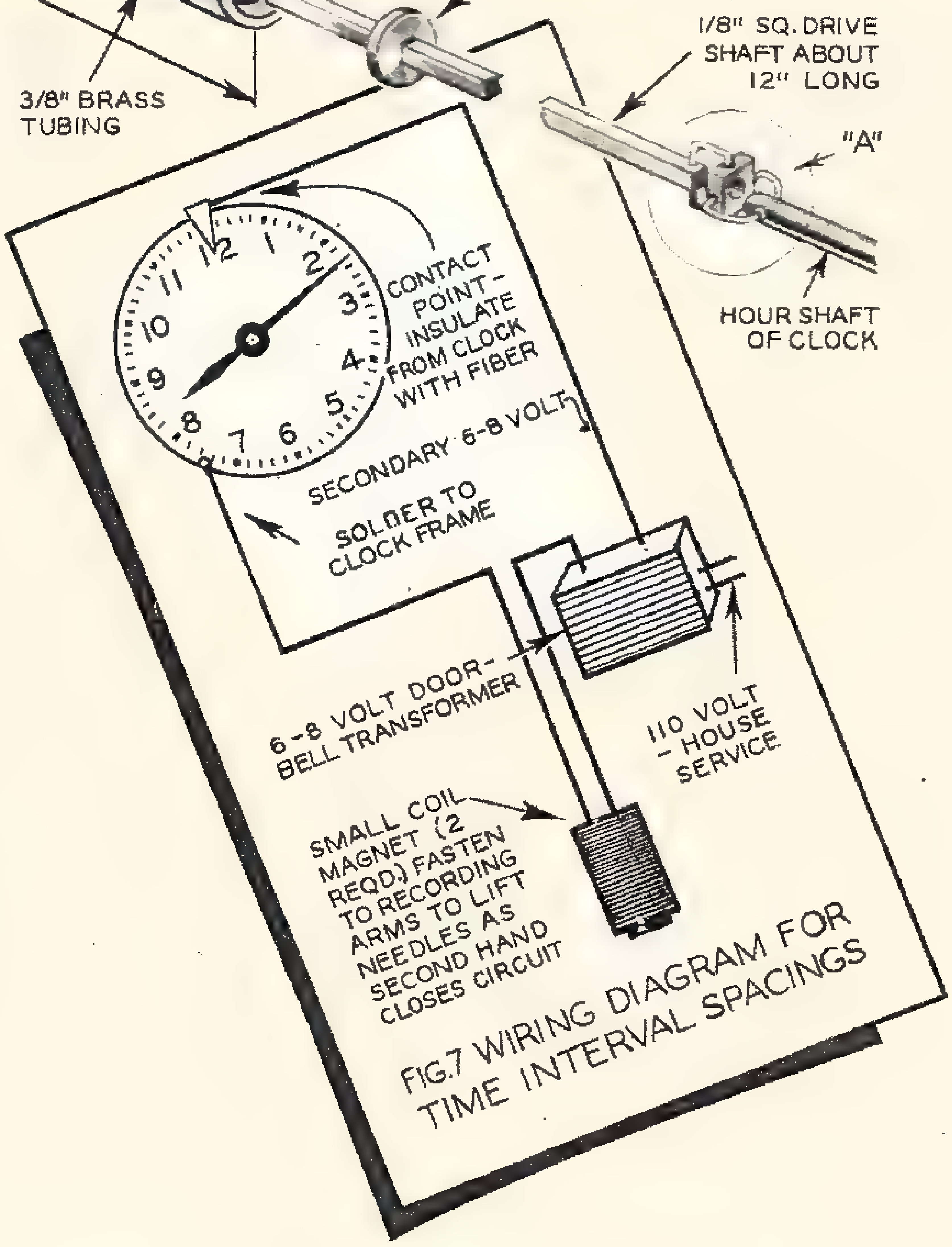

3/8" BRASS TUBING
1/8" SQ. DRIVE SHAFT ABOUT 12" LONG
"A"
HOUR SHAFT OF CLOCK
12
1
2
3
4
5
6
7
8
9
10
11
CONTACT POINT - INSULATE FROM CLOCK WITH FIBER
SECONDARY 6-8 VOLT
SOLDER TO CLOCK FRAME
6-8 VOLT DOOR-BELL TRANSFORMER
110 VOLT - HOUSE SERVICE
SMALL COIL MAGNET (2 REQD.) FASTEN TO RECORDING ARMS TO LIFT NEEDLES AS SECOND HAND CLOSES CIRCUIT

FIG. 7 WIRING DIAGRAM FOR TIME INTERVAL SPACINGS

Approximately 7 inches above the base, make three or four center punch marks, one above another, on each face of the angle iron.

This frame comprises the pier or support for the magnifying arms. It is now ready to be bolted to some firm, stationary foundation such as the garage floor. Care should be taken in placing the base (see Fig. 6), so that the faces of the angle iron will be in a true east-west, north-south position, so that you may determine the direction of a disturbance registered by the instrument. By using double nuts on the foundation, you are able to level the base and so keep the recording arms, to be mounted later, parallel to each other.

These magnifying arms should be made of some light metal beam, thirty inches long. Strips from an old Venetian blind or other light wood may be used instead, provided cross members and wire braces are attached to stiffen them.

Fashion two wooden shafts, as indicated

in Fig. 2, about ⅜-inch in diameter and from 4 to 8 inches in length. Into one end of each, insert an old phonograph needle, pointed end out. The other end of each shaft is later fitted with the lead weights.

Referring to Fig. 3, make two lead weights, exactly alike in heaviness, by pouring lead into two small tin cans. The weight of each should be between 5 and 10 pounds. Before pouring the lead, fasten in place two lengths of copper tubing such as used for automobile oil lines. One tube should run down the center of the tin can; the other should be run diagonally through the can, forming an angle of 45 degrees with the center tube. After the lead has cooled, remove the tubing and insert in the resulting holes the ⅜-inch rods, leaving the needled end protruding about 4 inches. Into the diagonal hole is fitted one end of the

[*Continued on page* 130]

Fig. 5, below, shows assembly of the recording needles. Magnets for raising needles hourly are optional and may be installed to end of magnifying arms by wiring them as shown.

S
W
E
CORRECT SETTING FOR PIER
REGULATE PERIOD OF OSCILLATION WITH BOLTS
PROJECTS 4" FROM WEIGHT
SCREW EYE IN WOOD PLUG
WEDGE ARM INTO TUBE OR DIRECT INTO WEIGHT
DETAIL AT WEIGHT
SUSPENSION WIRES
REST POINT IN CENTER PUNCH INDENTATION
CROSS-PIECE OF WOOD
BRACE WIRES
SEE FIG. 2
ANCHORED BASE
LATH
SEWING NEEDLE FORMS AXIS
SMALL CORK
CEMENT OR PIN TO ARM
SHAPE FROM 5" STRIP OF ALUMINUM
RECORDING NEEDLE
UNIVERSAL JOINT
SLIDING SHAFT
CARDBOARD DRUM 20" X 6" OR 8" DIAM.
NUT ABOVE AND BELOW TO ADJUST BASE LEVEL
RECORDING OR MAGNIFYING ARM, 30" LONG
1/2" BOLTS IMBEDDED IN CONCRETE
WOOD
KNIFE EDGE
CLOCK DRIVE BLOCK UP TO SHAFT LEVEL
SEE FIG. 4 FOR SHAFT DETAIL
LIGHT METAL SHAFT SUPPORT
RECORDING SHEET
PLANK BASE

FIG. 5 DETAIL OF MAGNIFYING ARM

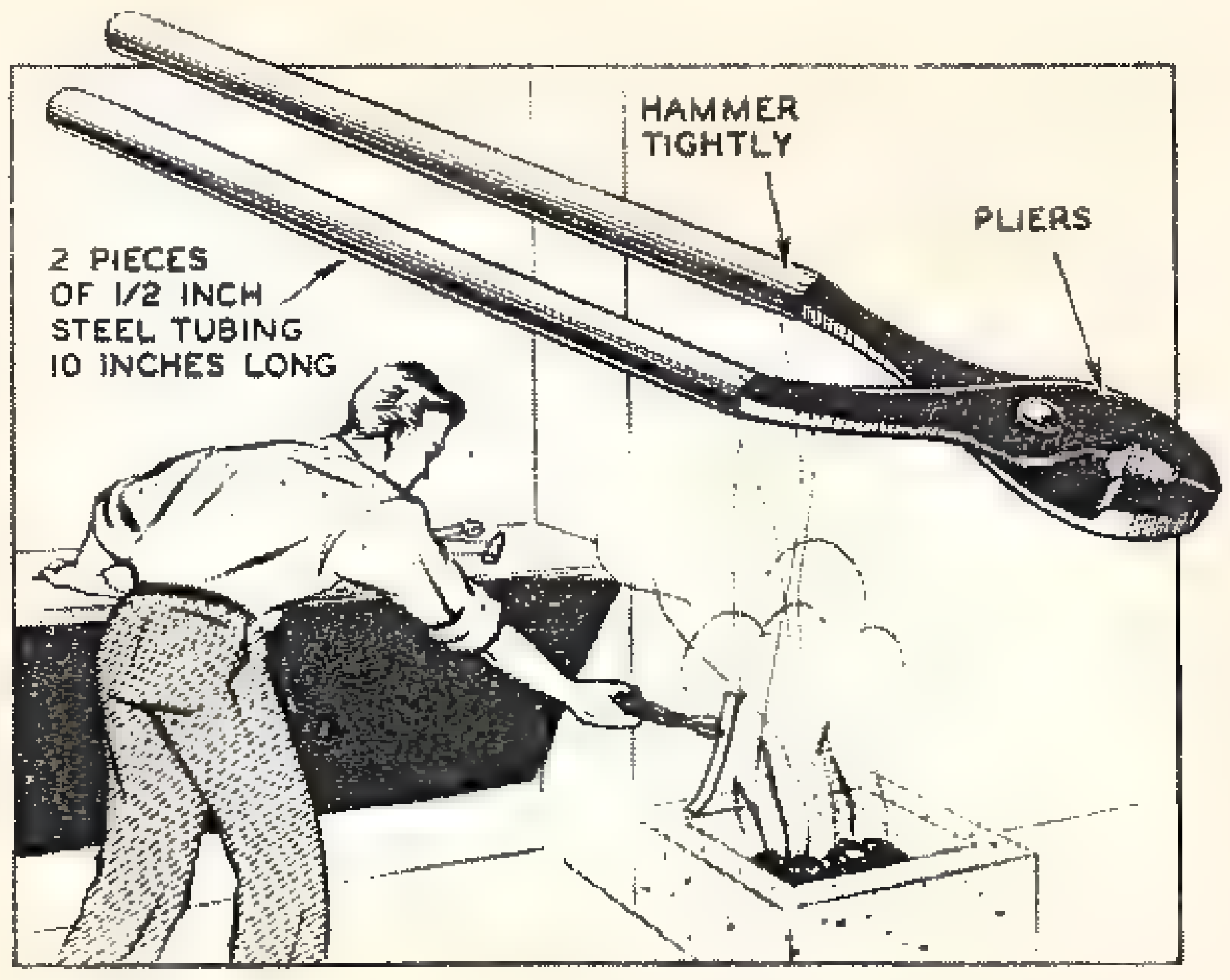
FIG. 6 PRINCIPAL ASSEMBLY

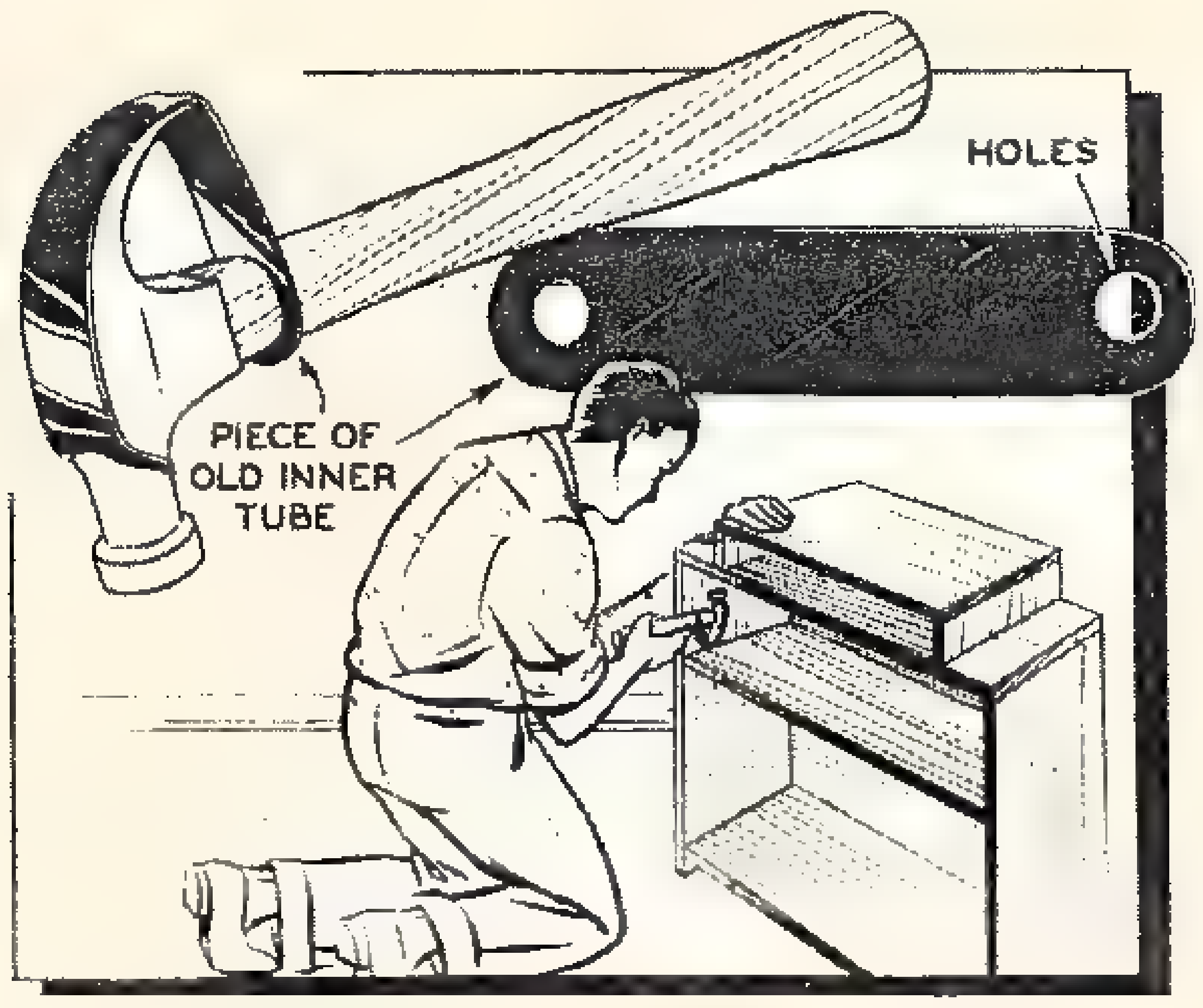
The completed seismograph is depicted above in perspective. A careful study of the details will insure the builder of an instrument of precision accuracy.

KINKS SIMPLIFY SHOP WORK

Steel Tubing Handle Extensions Increase Use Of Pliers

WHEN pliers are used for removing red hot pieces of metal from a forge, the heat at times becomes too great for comfort. When this is the case, two pieces of steel tubing slipped over the handles will make it possible to reach the object without the hands being burned. Before the tubing is fastened in place, straighten out the handles so that the tubing will not touch and thus prevent the jaws from closing. As the pliers can be adjusted to two opening sizes, they will pick up thin or thick pieces. In use, too much pressure should not be applied to the handles as they might show a tendency to bend.—H. Paisley.


HAMMER TIGHTLY
PLIERS
2 PIECES OF 1/2 INCH STEEL TUBING 10 INCHES LONG

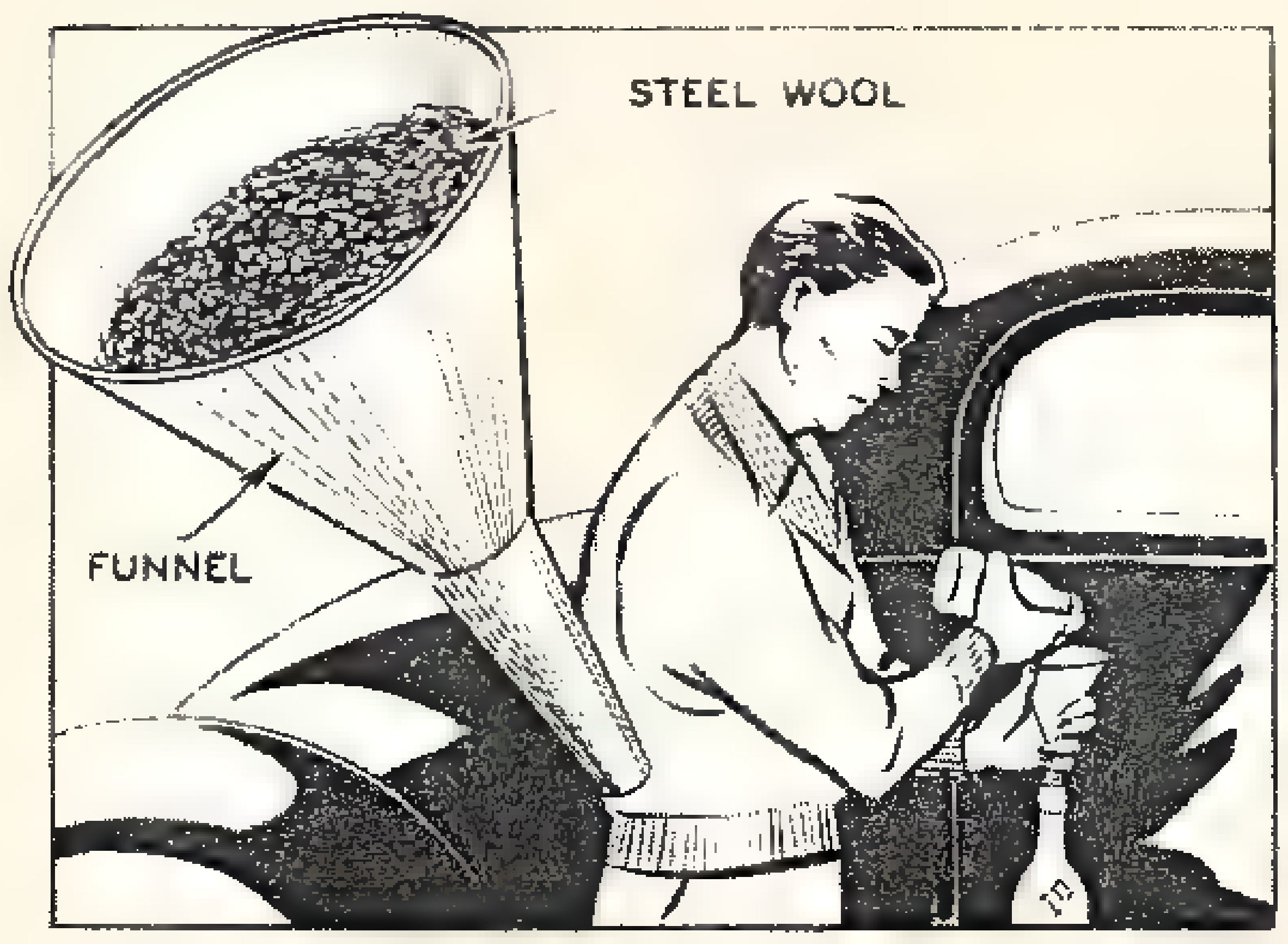

HOLES
PIECE OF OLD INNER TUBE

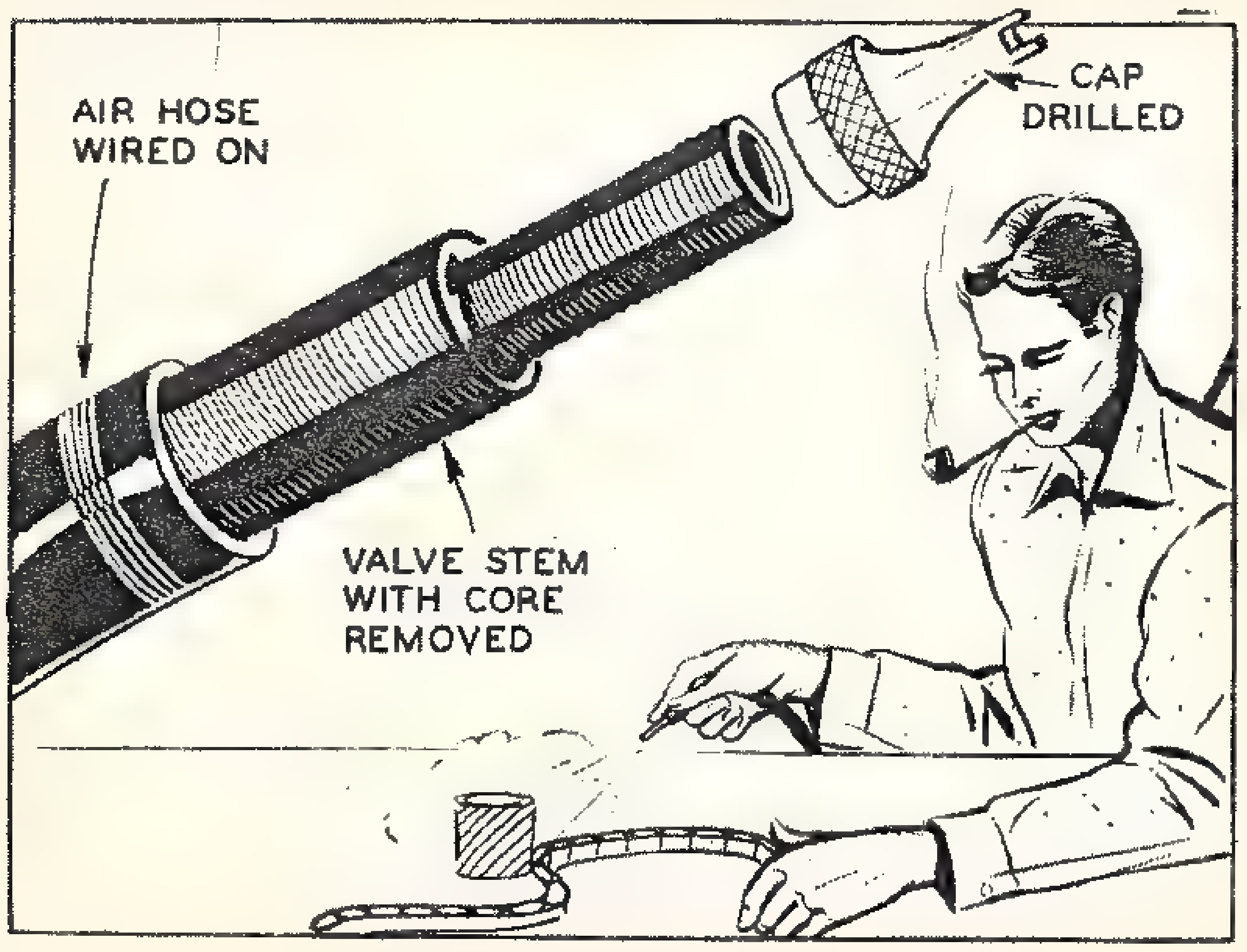
Inner Tube Prevents Hammer Marks

A PIECE of old inner tubing fastened over the top of the hammer as shown in the drawing will prevent unsightly dents or marks when the hammer is used in a small space. After the holes are cut in the rubber the hammer handle is passed through one end. The hammer face then is passed through the other hole. The strip should be of such size that it fits tightly over the hammer. When the claws are to be used for drawing nails the rubber strip can be removed.

Steel Wool Becomes Good Filter

WHEN straining some types of liquids and the correct filter is not available, a piece of steel wool in a funnel becomes a good substitute. Use plenty of wool but do not pack it too tightly. If the liquid does not pass through rapidly enough, loosen the wool slightly. This material is not suitable for acid or alkaline solutions, as the metal would be affected. Various grades of steel wool can be tried according to the material to be filtered. —H. Paisley.

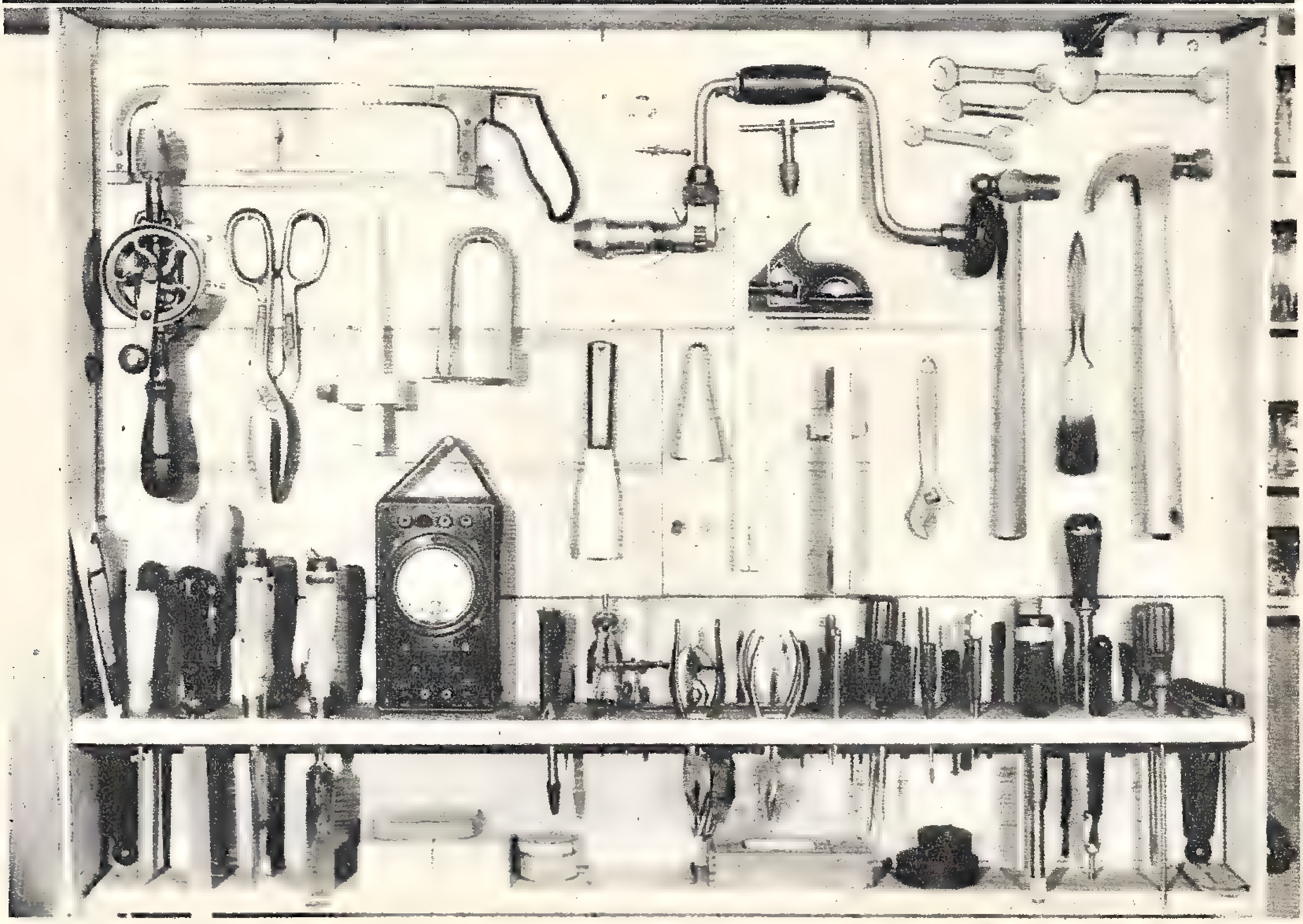




Air Nozzle From Valve Cap

SMALL air nozzles can be made easily from a valve stem and cap. The stem first is cut from the inner tube and the valve core removed. A hole then is drilled through the valve cap. The rubber hose from the compressor next is fastened securely to the end of the stem. The valve cap is screwed into place and the device is ready for use. The amount of air flowing from the nozzle can be regulated according to the size of the opening. Several sizes can be drilled and used when necessary.—H. Paisley.

Your Cellar Shop Can Be Neat



A NEAT shop usually is also an efficient shop, in that tools and supplies can be found quickly when they are needed. The man who throws chisels, screwdrivers, pliers and brushes indiscriminately into an old fruit box certainly is not a good workman.

The above illustration shows a very simple but highly convenient arrangement of tools. Everything is in open sight and is accessible for instant use. The backboard consists merely of three four-foot lengths of shelving cleated together on the back and hung from the wall of the cellar by means of a couple of large expansion bolts driven into the cement. The tools themselves are placed over finishing nails driven partly into the board.

A four-inch wide shelf of soft pine, bracketed to the lower edge of the backboard, holds small tools such as screwdrivers, pliers, center punches, nail sets, files and wood chisels. The fine edges of the latter rest in slots cut in a bottom board, and are thus protected against injury. The bottom board is also useful for holding small flat objects such as rolls of tape, cans of soldering flux, etc. This bottom board should clear the top of the workbench by about six inches.

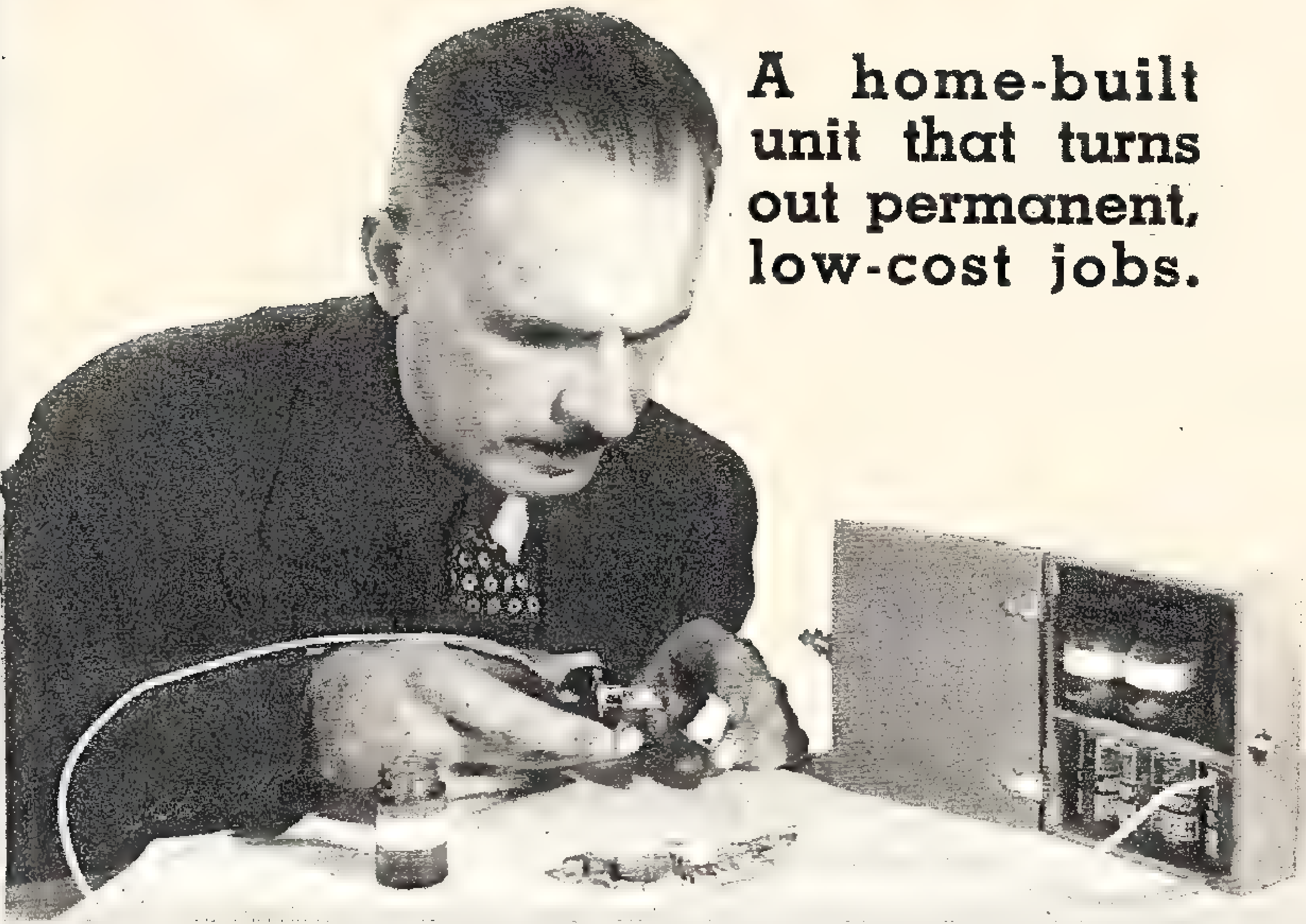
If the house uses a coal burning furnace and dust is a problem, it is a good idea to fit the tool rack with a curtain made of heavy cloth. This can be pinned aside when the shop is in use. Some men prefer hinged covers which swing open. These are useful for holding light, flat tools.

Glass jars with screw caps make ideal containers for screws, nuts, washers, soldering lugs, etc. They do not need labels, as their contents are clearly visible.

Pocket Electro

A home-built unit that turns out permanent, low-cost jobs.

The ends of the glass tubes used in making electrodes are flared over a bunsen burner flame (below).



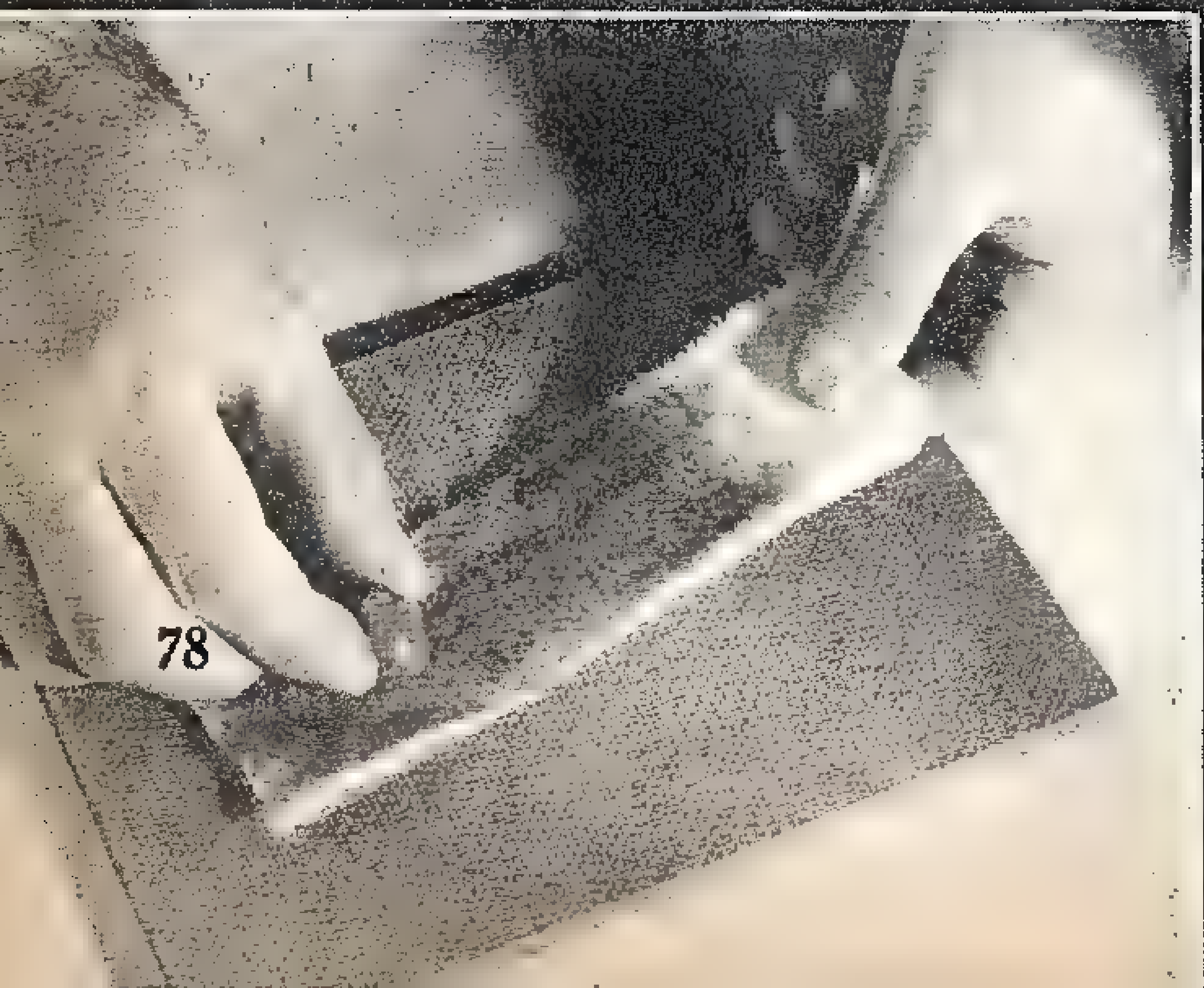
Plating articles of jewelry with the compact electroplating outfit, shown above, is an easy and simple process, but the objects must be clean and free of grease, otherwise the job will appear streaked.

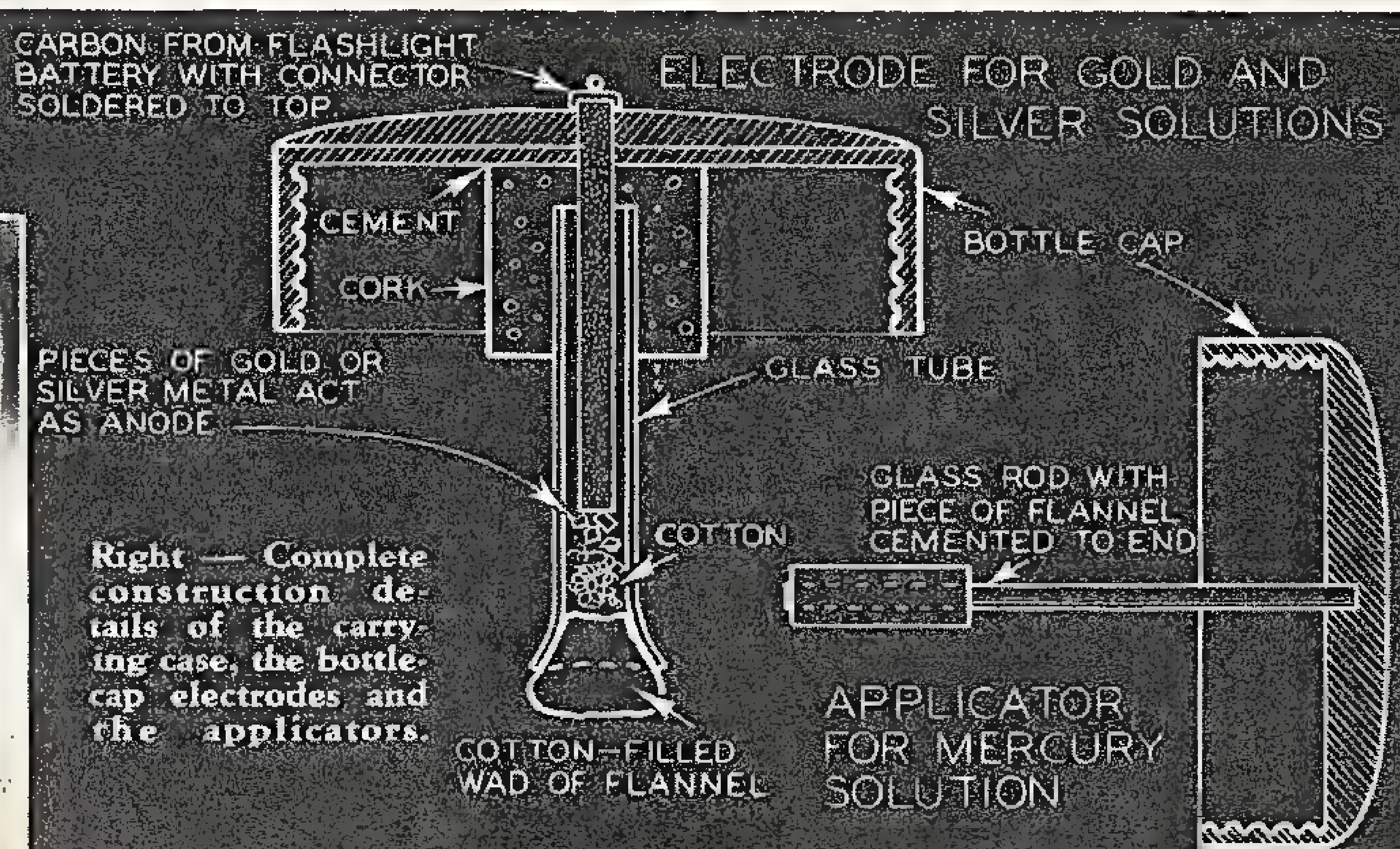
HERE is a complete electroplating outfit—batteries, chemical solutions, applicators and polish—which is contained in a case no larger than your hand, and small enough to easily fit in your pocket. An even smaller outfit, for the vest pocket, can be made by using tiny "penlite" size batteries, and by substituting glass vials for the 1-ounce plating solution bottles chosen for this model.

Despite its miniature size, this is a thoroughly practical outfit and with it you can electroplate a thin or a heavy deposit of gold or silver on any small article. It is particularly suited to the plating or refinishing of small pieces of jewelry, on which it does first-class work in a remarkably short time. As for larger work, it will handle the replating of silverware, and you can gold plate the handles of knives and forks and similar articles if you wish. Automobile head-lamp reflectors can be resilvered when the finish becomes dull, and other automotive parts can be gilded, if you wish, at a cost of only a few cents. The work done by the outfit is as durable and permanent as that done by professional, large-scale plating methods.

First construct the case, using pressed wood and following the dimensions shown in the accompanying drawings. Although for purposes of illustration the case is made of

A polishing cloth, for burnishing the plated silver or gold, is made by rubbing a strip of flannel with jewelers' rouge (below).



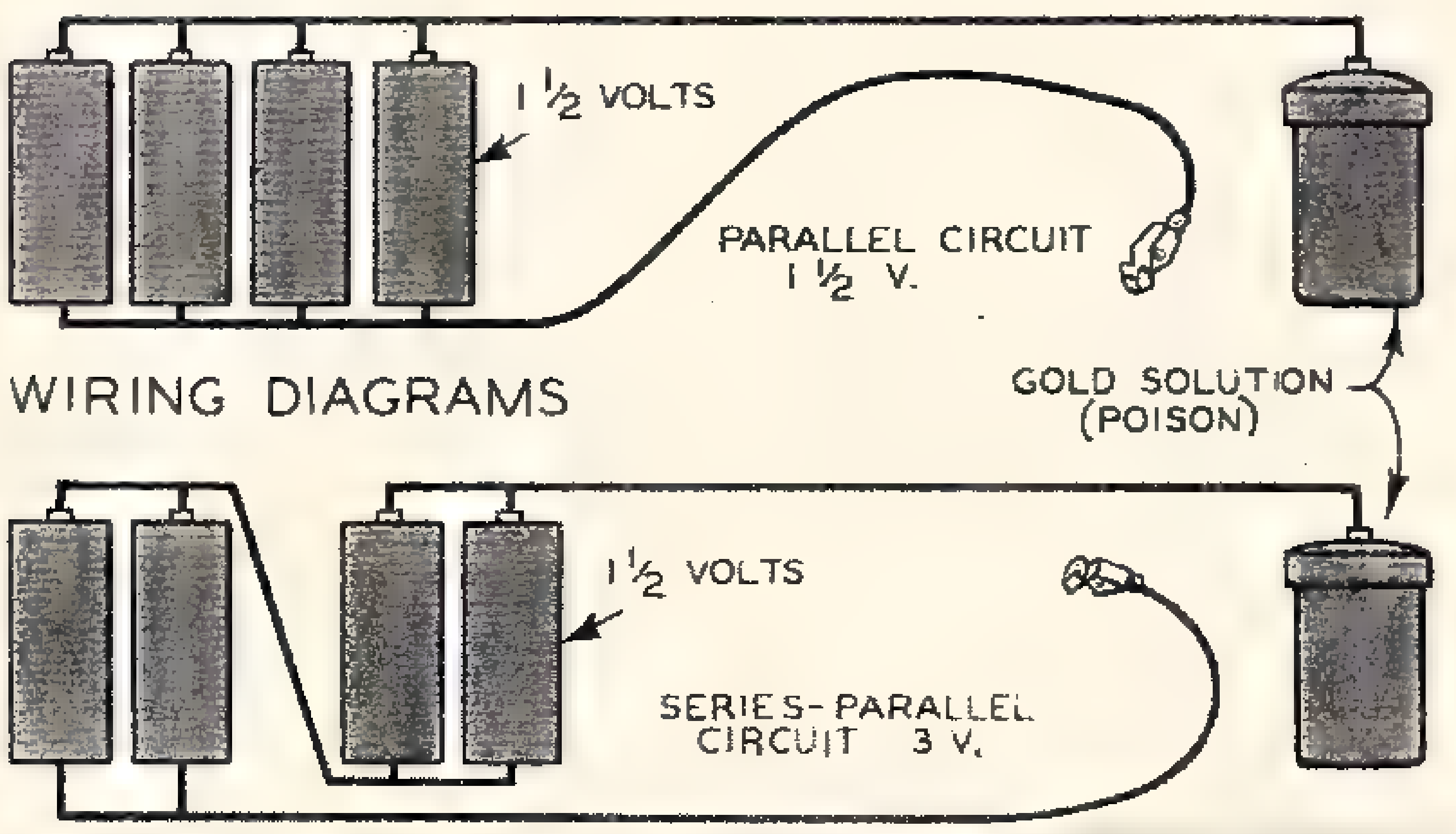


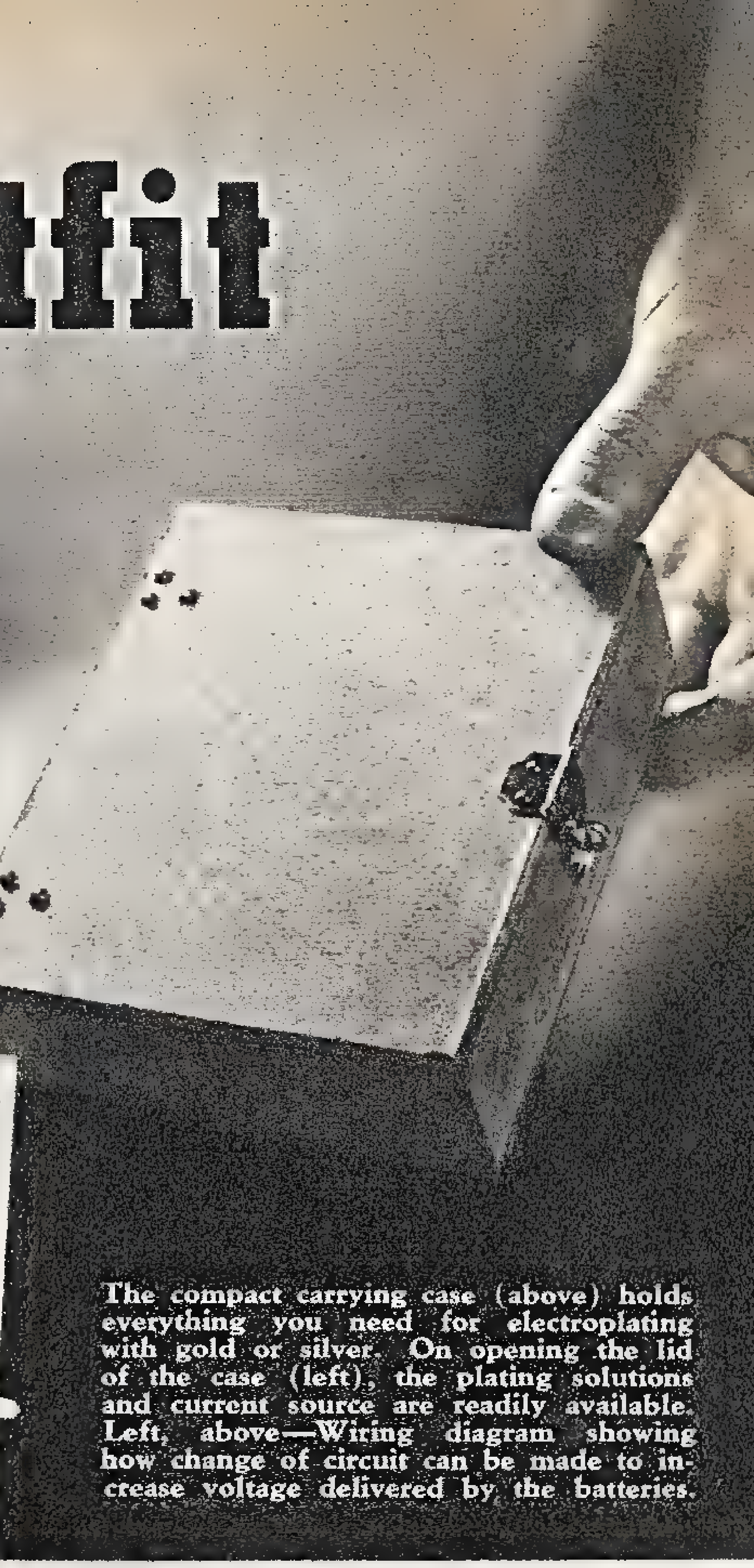
CARBON FROM FLASHLIGHT BATTERY WITH CONNECTOR SOLDERED TO TOP
ELECTRODE FOR GOLD AND SILVER SOLUTIONS
CEMENT
CORK
BOTTLE CAP
PIECES OF GOLD OR SILVER METAL ACT AS ANODE
GLASS TUBE
GLASS ROD WITH PIECE OF FLANNEL CEMENTED TO END
COTTON
COTTON-FILLED WAD OF FLANNEL
APPLICATOR FOR MERCURY SOLUTION

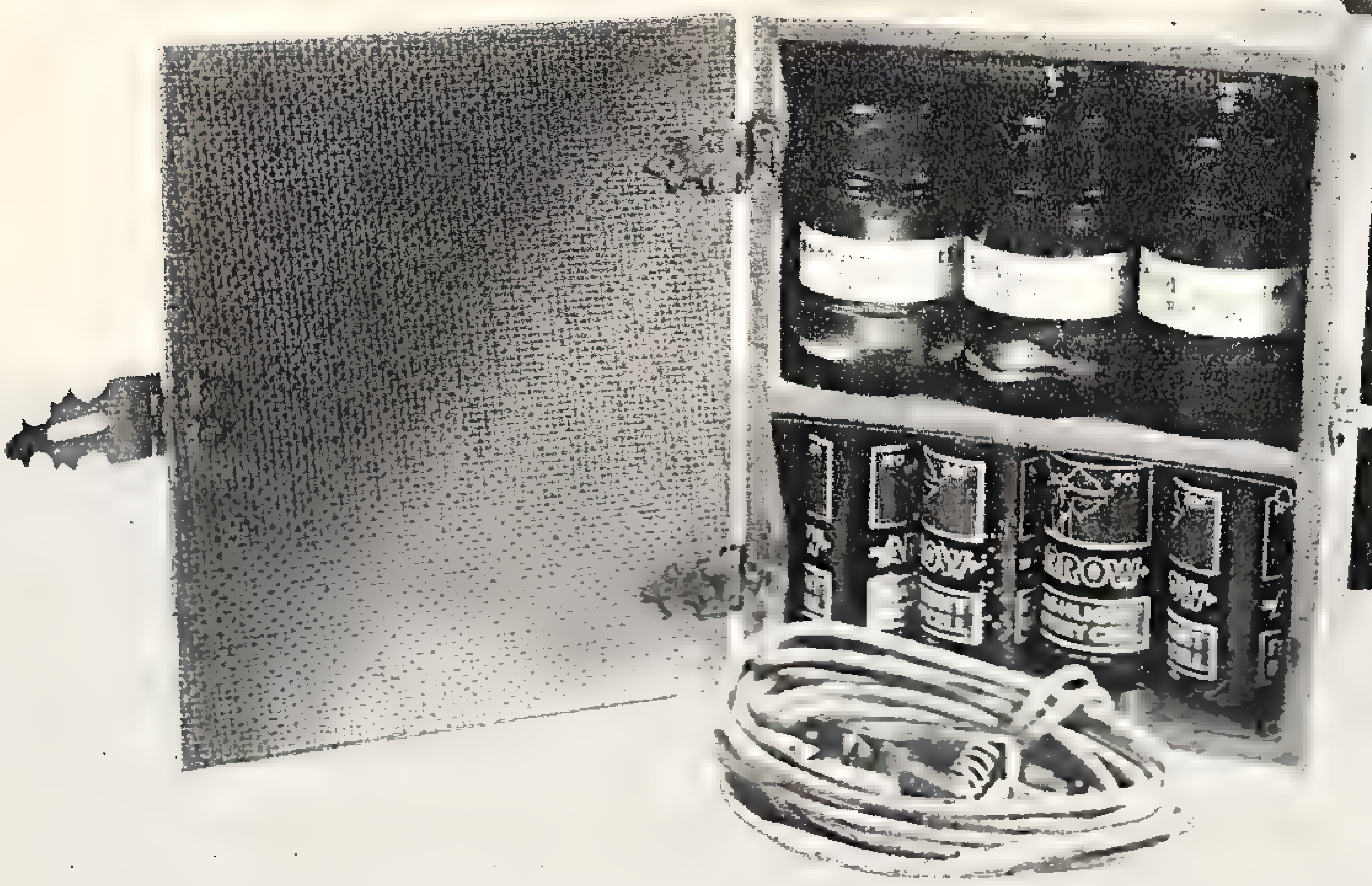
Right — Complete construction details of the carrying case, the bottle-cap electrodes and the applicators.

Plating Outfit

by Kenneth Murray


1 ½ VOLTS
PARALLEL CIRCUIT 1 ½ V.
WIRING DIAGRAMS
GOLD SOLUTION (POISON)
1 ½ VOLTS
SERIES-PARALLEL CIRCUIT 3 V.

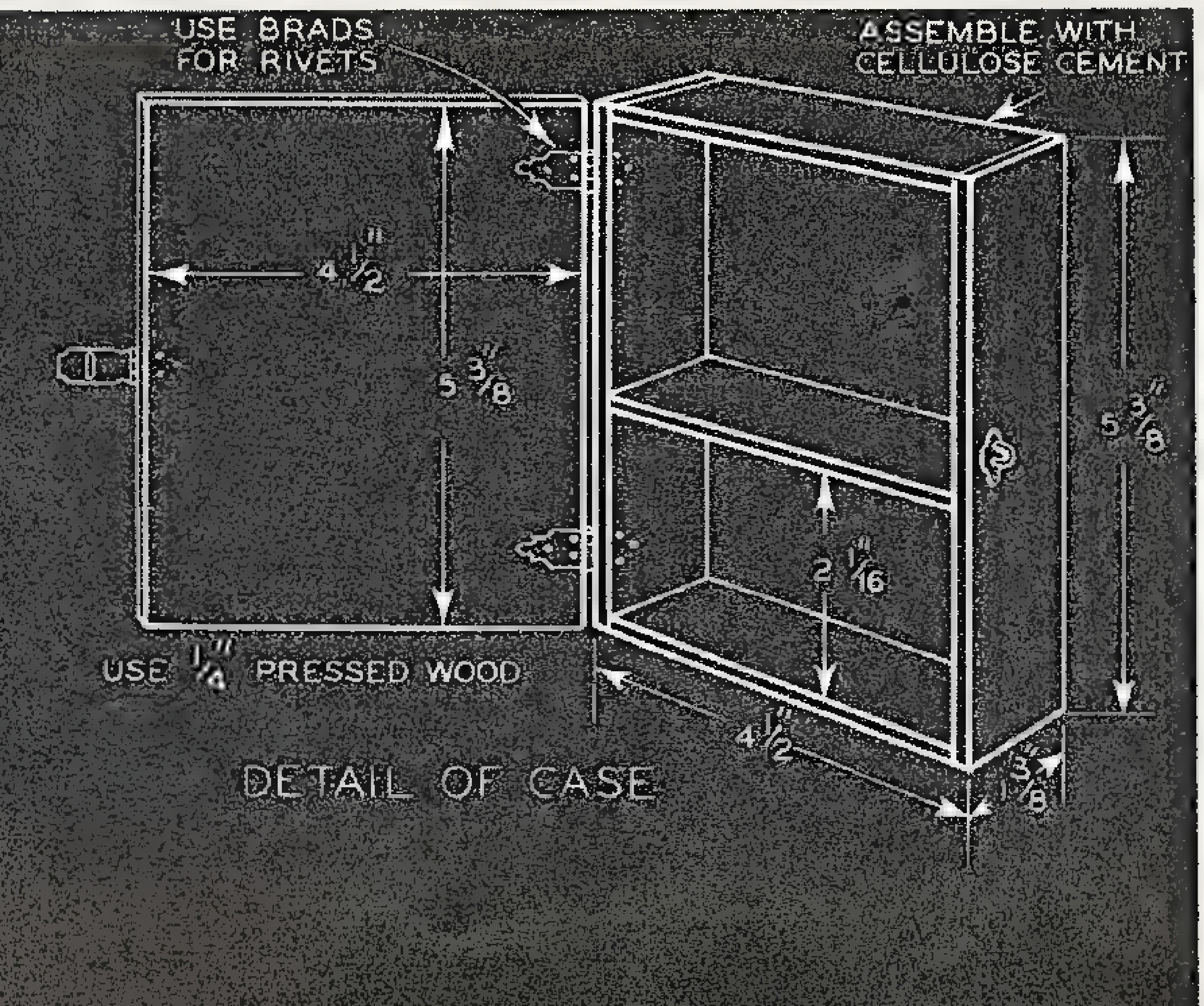




The compact carrying case (above) holds everything you need for electroplating with gold or silver. On opening the lid of the case (left), the plating solutions and current source are readily available. Left, above—Wiring diagram showing how change of circuit can be made to increase voltage delivered by the batteries.

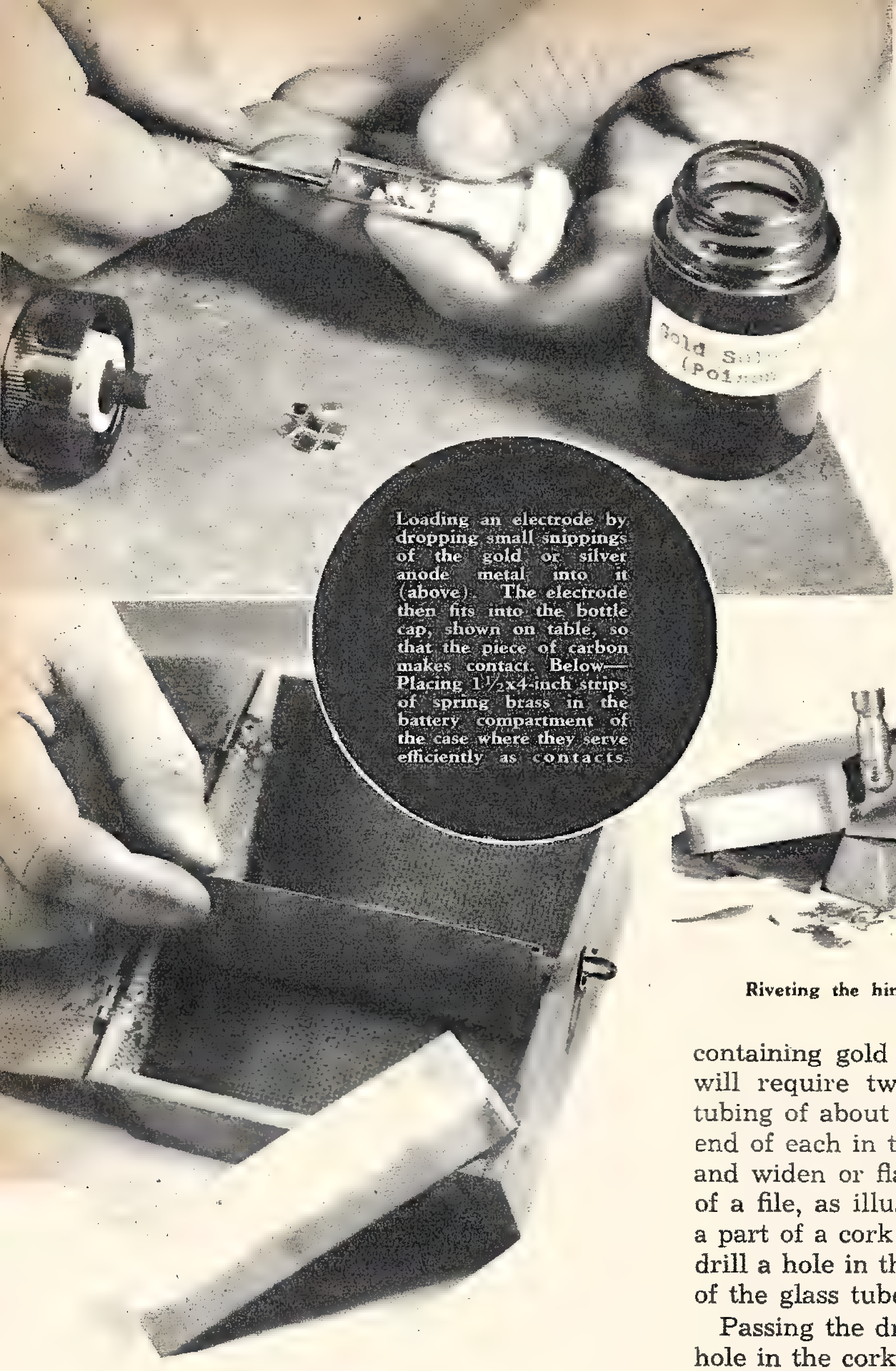
pressed wood in the natural finish, you can also build it in ebony black, which presents a very fine appearance. Small brads, cut ⅜-inch long, are used for riveting the hardware hinges and lock in place. Four brass upholstery tacks may be attached to the bottom to serve as rests, if desired.

You will notice that the battery space, or lower compartment, is just large enough for small flashlight cells. The method of making contact is shown in a photograph on page 80; two strips of thin spring brass, each 1½ by 4 inches, are given a slightly convex bend so as to make good contact with the positive and negative poles of the batteries. Small tabs left on the ends are rolled around a piece of wire to receive the tinned leads which connect with the electrode and the spring clip with which the work is held.


USE BRADS FOR RIVETS
ASSEMBLE WITH CELLULOSE CEMENT
4 ½"
5 ⅜
5 ⅜"
2 1/16"
USE ¼" PRESSED WOOD
4 ½"
⅜"
DETAIL OF CASE

This circuit will deliver about 1½ volts to the electrode, which is usually sufficient. According to the amount of resistance in the electrode, as will be mentioned later, it may be desirable to use a series-parallel circuit, delivering about 3 volts, in order to speed up the deposition of plating metal. The method of wiring the batteries for a series-parallel circuit is shown in one of the accompanying drawings.

In order to make the combined electrodes and plating solution container units, get three 1-ounce wide-mouth glass bottles from your



Loading an electrode by dropping small snippings of the gold or silver anode metal into it (above). The electrode then fits into the bottle cap, shown on table, so that the piece of carbon makes contact. Below—Placing 1½x4-inch strips of spring brass in the battery compartment of the case where they serve efficiently as contacts.

Riveting the hinges to the case with small brads.

druggist. Those illustrated are of green glass, about 1¼ inches in diameter and 2¼ inches high, including the black bakelite cap. Each bottle is to be half filled with the respective working solution and labeled. The labels can be protected and neatly finished by covering them with strips of celluloid cemented around the bottles.

The bottle containing the mercury solution is fitted with a narrow glass rod, or tube, which is cemented into a hole drilled part way through the center of the cap. Wrap a strip of flannel around the free end, using a little cellulose cement to hold it, so that it can be used as a swab.

The electrodes for the other two bottles, containing gold and silver plating solutions, will require two 1¾-inch lengths of glass tubing of about ⅜-inch diameter. Heat one end of each in the flame of a bunsen burner and widen or flare it outward with the tang of a file, as illustrated on page 78. Cement a part of a cork inside each bakelite cap and drill a hole in the cork to take the other end of the glass tube.

Passing the drill through the center of the hole in the cork, make a hole in the bakelite cap to receive a piece of *clean* round carbon taken from a small flashlight battery. Cement it into the bottle cap so that only the brass cap on the end of the carbon projects. To this solder a connector for the wire to the positive side of the battery circuit.

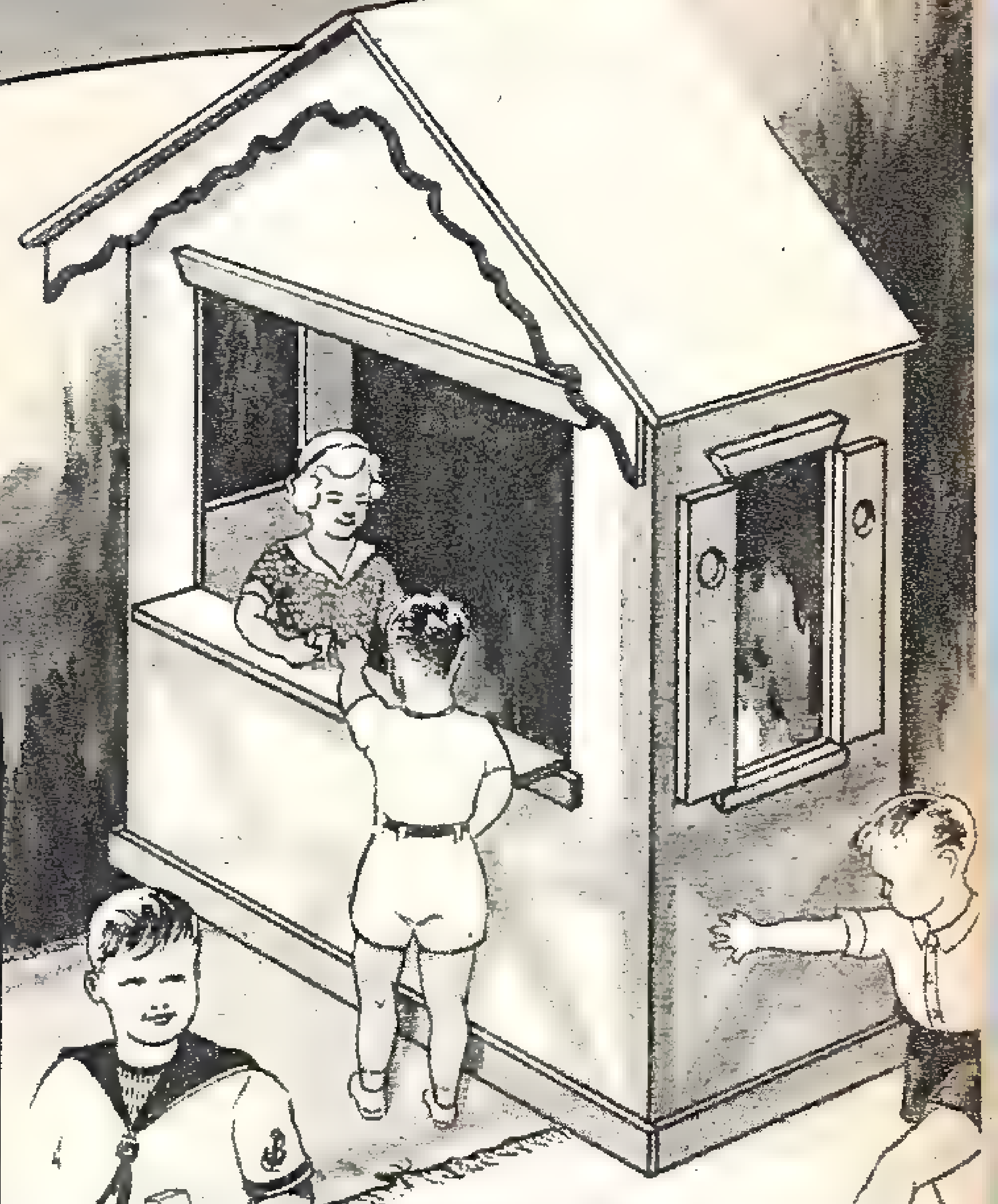
Returning to the glass tubing which you have prepared, pass the ends of a short strip of flannel into the flared end, and with a bit of cotton in the fold. The object is to make a wide swab with which the electroplating solution may be "painted" over the metal surface that is to be plated. Stuff a little more cotton into the tube, from the other end, and on top of the cotton drop a few pieces or snippings of gold or silver, as the case may be.

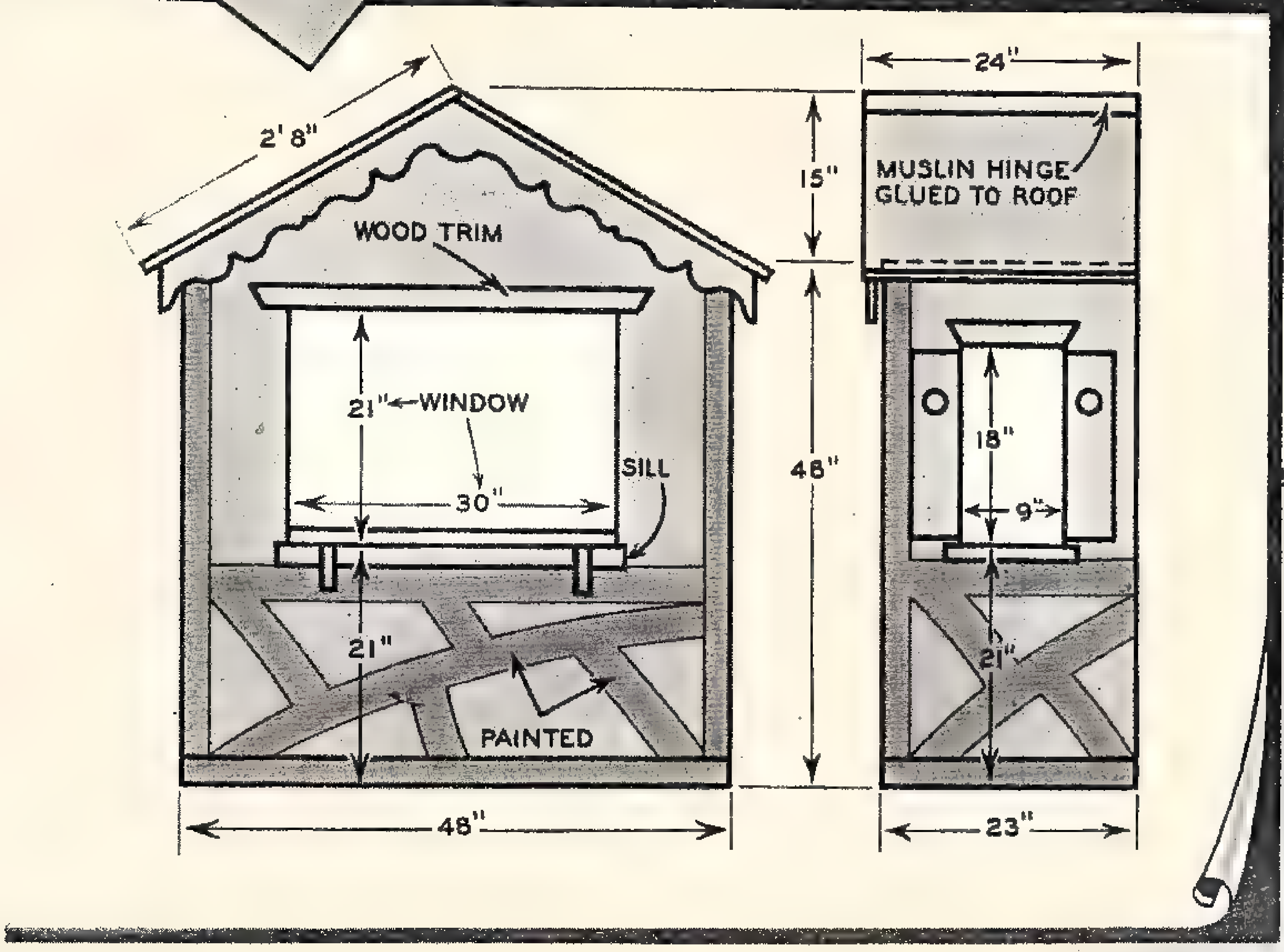
[*Continued on page* 120]

INDOOR OUTDOOR PLAYSTORE

A FOLDING PORTABLE PLAYHOUSE SCREEN

by
Hi Sibley



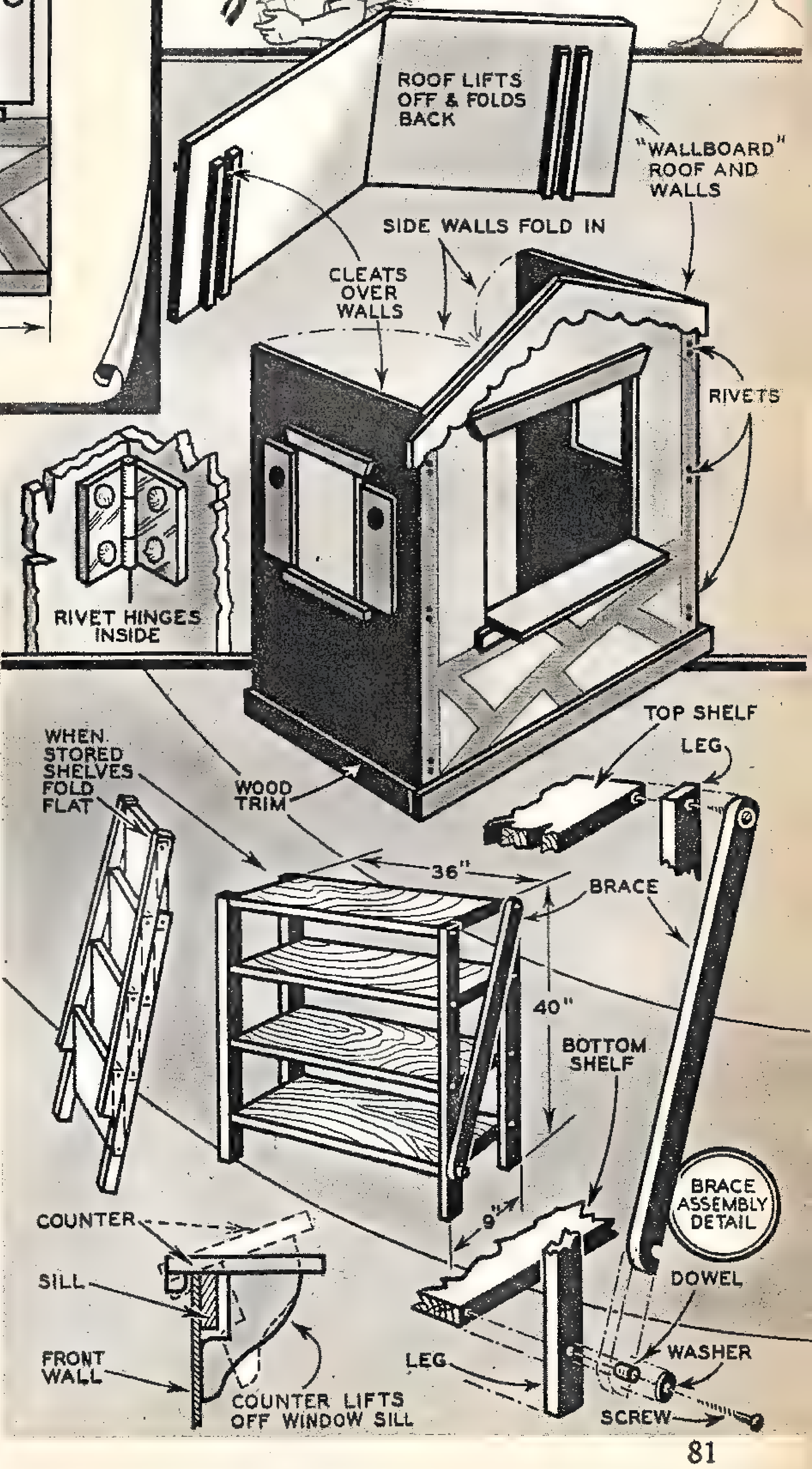

2' 8"
WOOD TRIM
21" ←WINDOW
30"
SILL
21"
PAINTED
48"
24"
15"
MUSLIN HINGE GLUED TO ROOF
48"
18"
9"
21"
23"

THIS play store has the double advantage of being very inexpensive to build, and when completed can be folded flat and stored in a small closet. It can be constructed from two panels of light wallboard, one of them 4 by 8 and the other 4 by 4 feet. Odd pieces of lumber will do for sills, eaves, etc. The shutters are simply scrap wallboard cut from the front window.

Three pairs of hinges are riveted to the wallboard on the inside for the folding side walls. The roof is hinged with muslin glued along the ridge after the roof is in place, cleats having been fastened to the under side along the line of the eaves. A counter is made as shown in the sectional drawing, to be set over the front window sill.

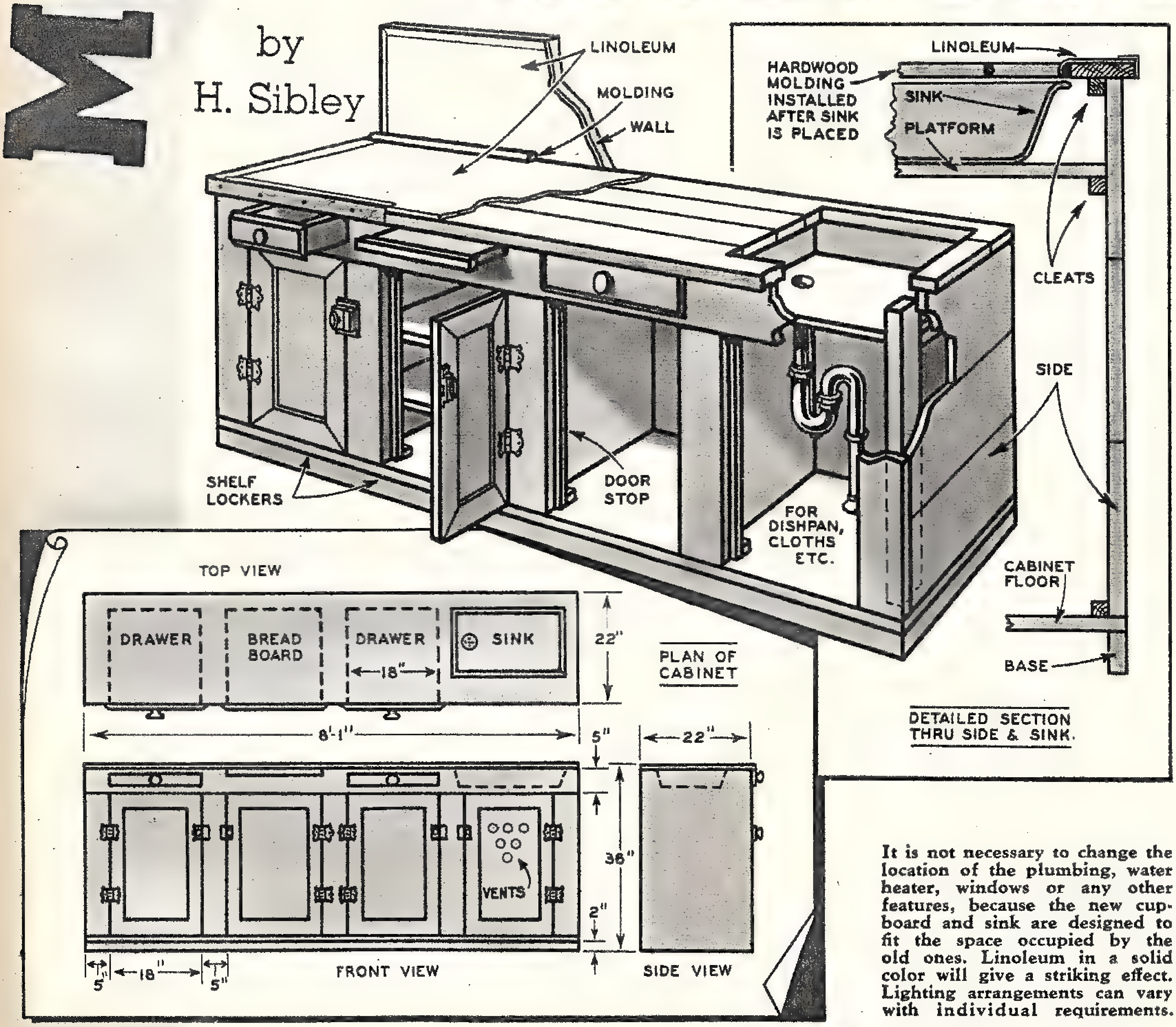
Folding shelves are built as shown, and can also be stored in small space.

Constructed of light wallboard and odd pieces of lumber, this play store is easily built and will give the youngsters a convenient and pleasant place in which to play. When not in use, the entire structure can be folded flat and stored. Because of its light weight it can be moved easily. Bright colored paint adds to its appearance.

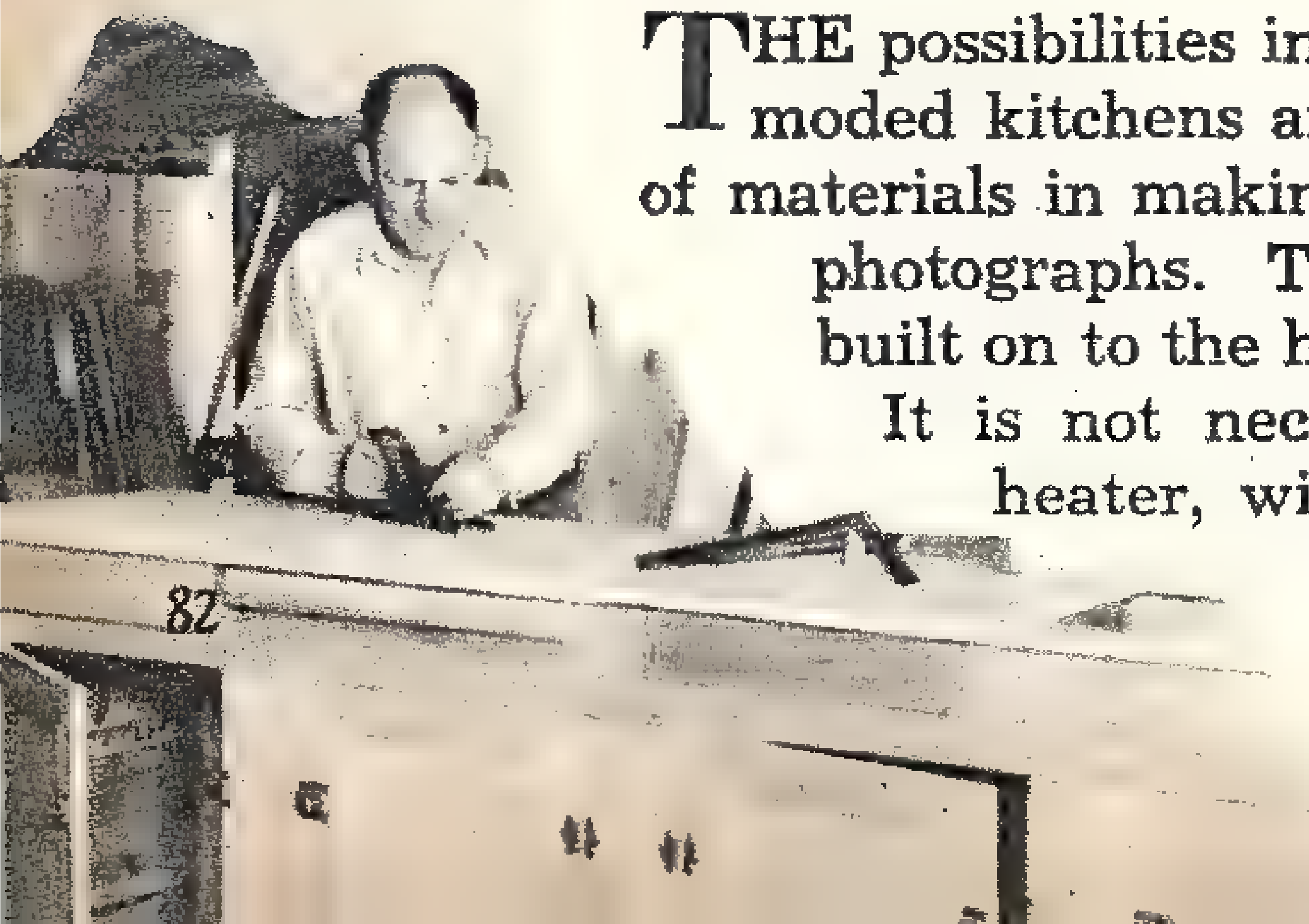

ROOF LIFTS OFF & FOLDS BACK
"WALLBOARD" ROOF AND WALLS
SIDE WALLS FOLD IN
CLEATS OVER WALLS
RIVETS
RIVET HINGES INSIDE
WHEN STORED SHELVES FOLD FLAT
WOOD TRIM
TOP SHELF
LEG
36"
BRACE
40"
BOTTOM SHELF
9"
BRACE ASSEMBLY DETAIL
COUNTER
SILL
FRONT WALL
COUNTER LIFTS OFF WINDOW SILL
LEG
DOWEL
WASHER
SCREW

MODERNIZING OUTMODED FARM KITCHENS

by
H. Sibley


LINOLEUM
MOLDING
WALL
SHELF LOCKERS
DOOR STOP
FOR DISHPAN, CLOTHS ETC.
LINOLEUM
HARDWOOD MOLDING INSTALLED AFTER SINK IS PLACED
SINK
PLATFORM
CLEATS
SIDE
CABINET FLOOR
BASE
DETAILED SECTION THRU SIDE & SINK.
TOP VIEW
DRAWER
BREAD BOARD
DRAWER
18"
SINK
22"
PLAN OF CABINET
8'-1"
5"
22"
36"
2"
VENTS
5"
18"
5"
FRONT VIEW
SIDE VIEW

It is not necessary to change the location of the plumbing, water heater, windows or any other features, because the new cupboard and sink are designed to fit the space occupied by the old ones. Linoleum in a solid color will give a striking effect. Lighting arrangements can vary with individual requirements.



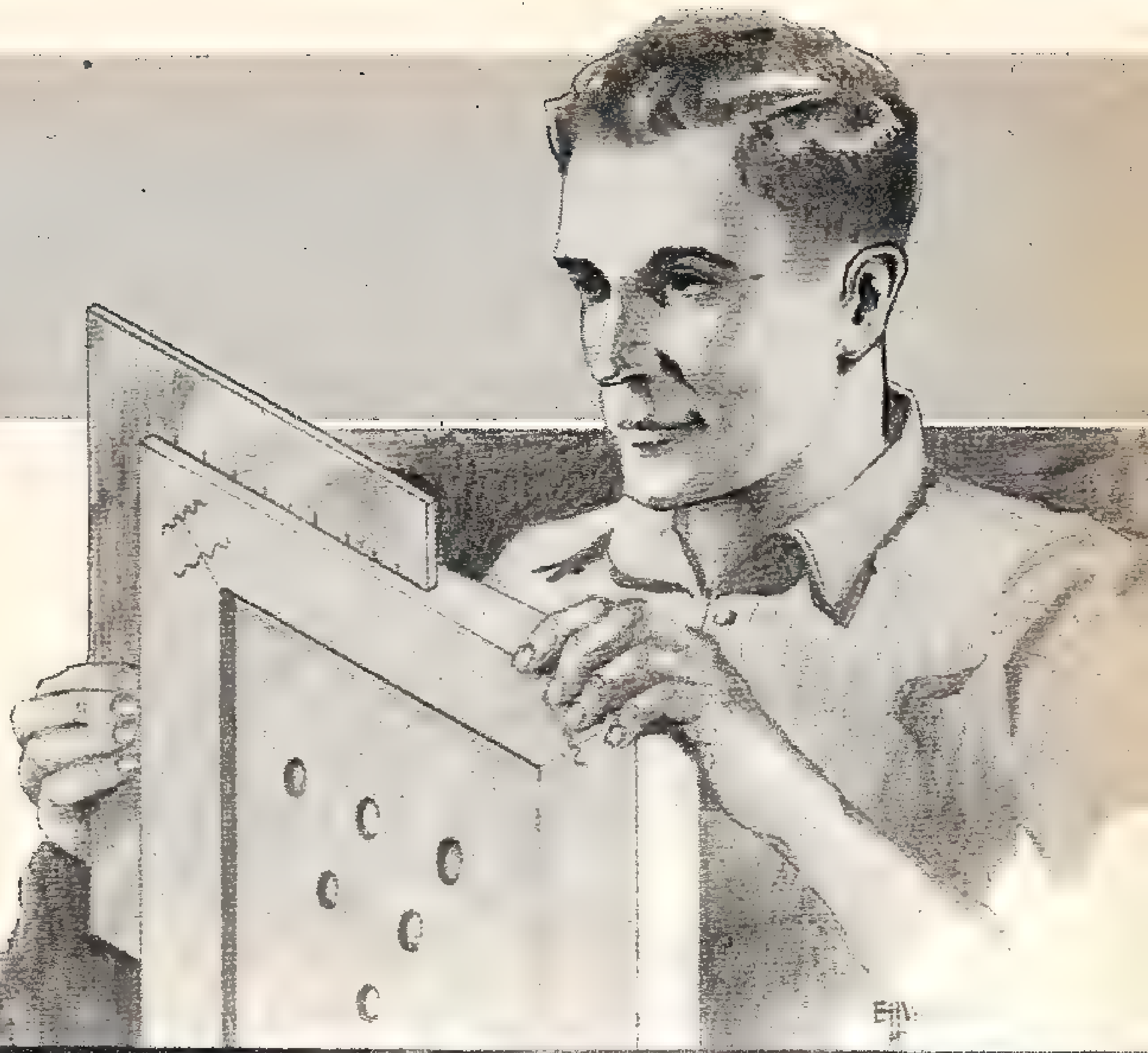
THE possibilities in improving the appearance and convenience of old, outmoded kitchens are so great that one will not begrudge the time and cost of materials in making the change. A typical example is illustrated in these photographs. This case is interesting because originally it was a lean-to built on to the house in the manner of an enclosed porch.

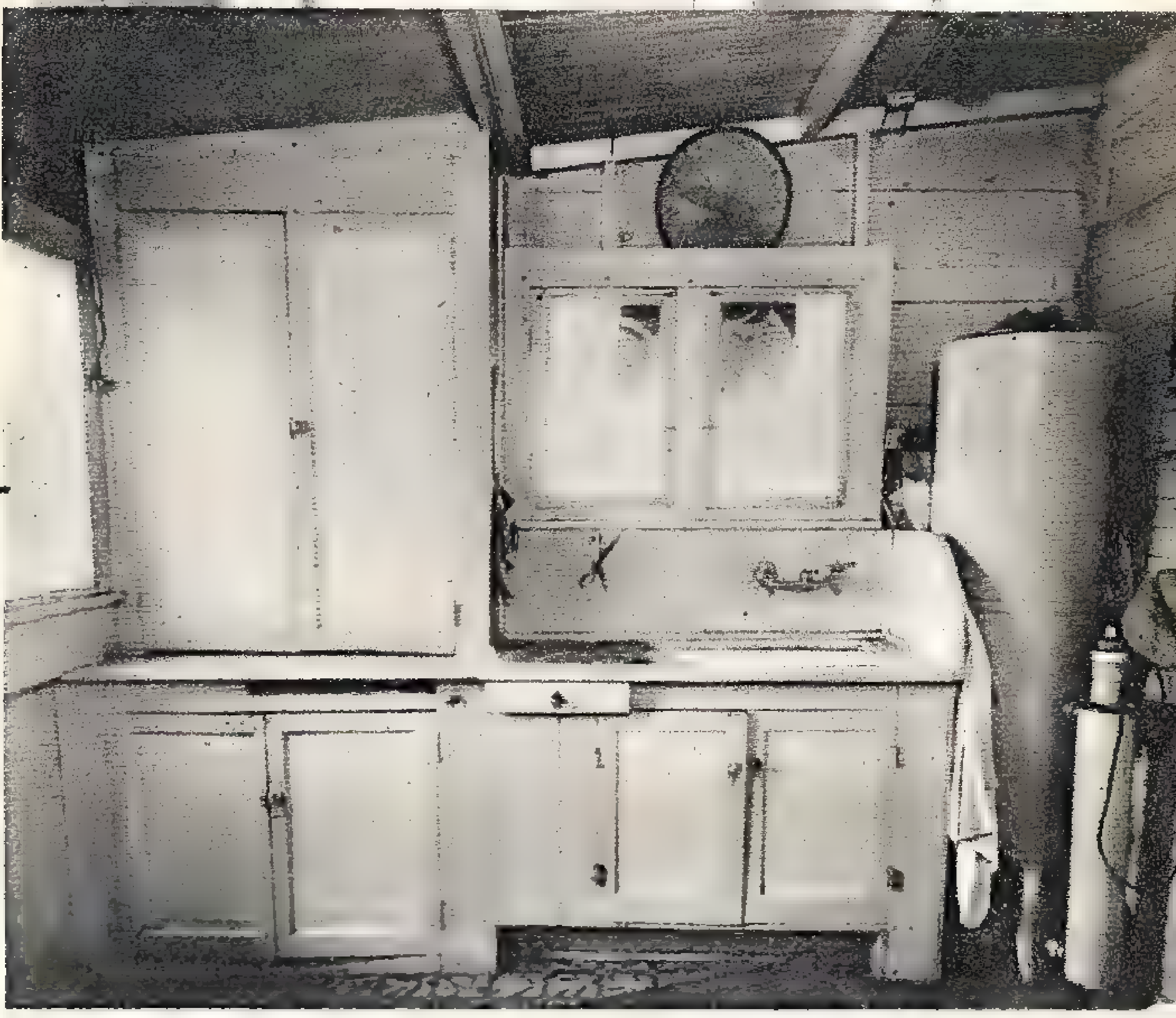
It is not necessary to change the location of the plumbing, water heater, windows or any other feature because the new cupboard and sink were designed to fit into the space occupied by the old ones.

Dimensions given in the drawing are general and can be adapted to the individual case. Construction throughout is of pine and since it is to be painted, the most expensive grade is not required. Construction of the cabinet follows standard practice, with the usual drawers, rails, cleats, door stops, sink compartment, etc. In this job the sink bottom rests on boards instead of being suspended by the rim, permitting installation after the cabinet top is put on permanently.

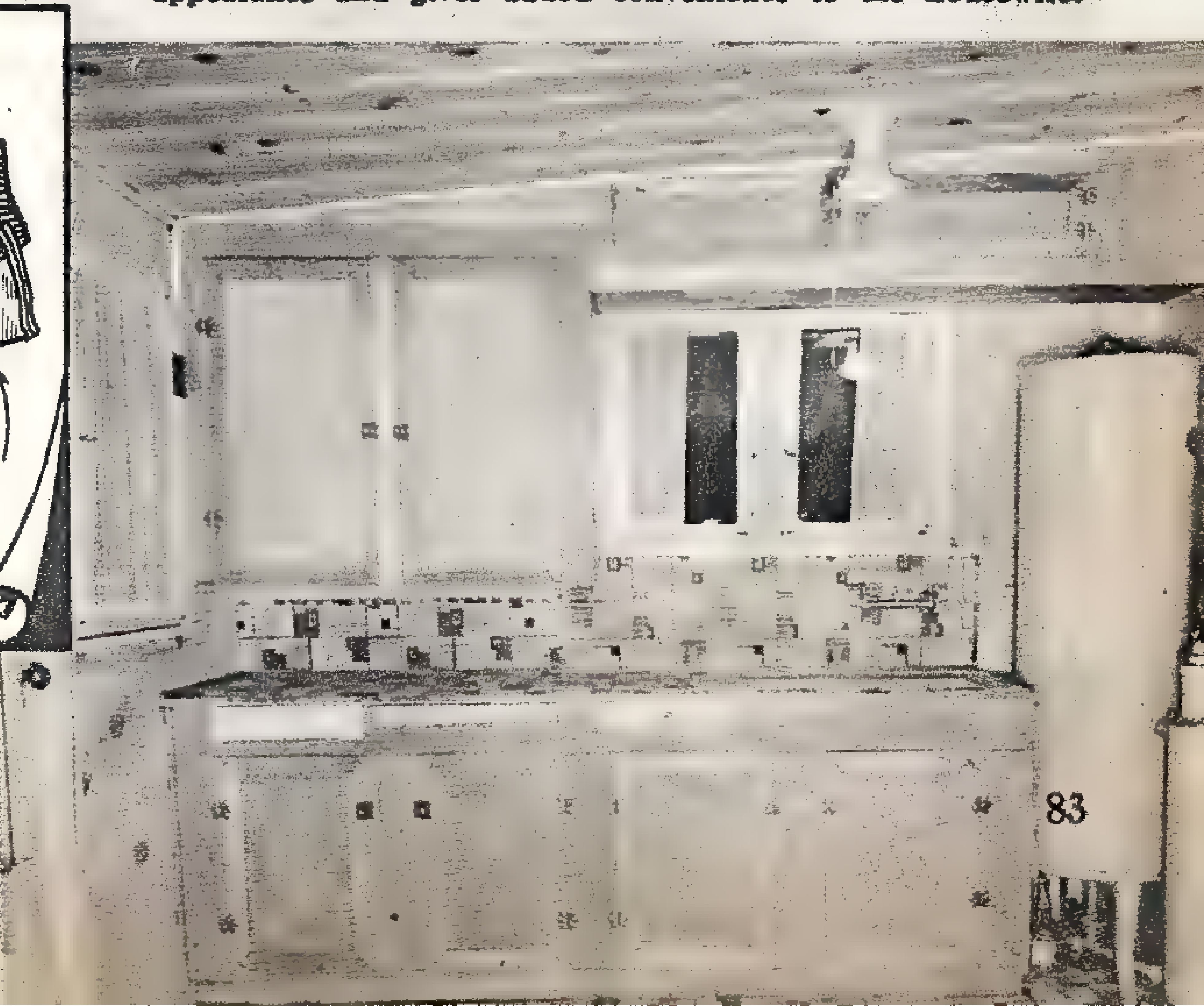
Cabinet doors are simply four mitred and rabbeted frame-members assembled upon a plywood panel, and secured with casein glue and corrugated fasteners. Drawers and bread-board are provided, the former fitted with drawer pulls, the latter having a strip across the front.

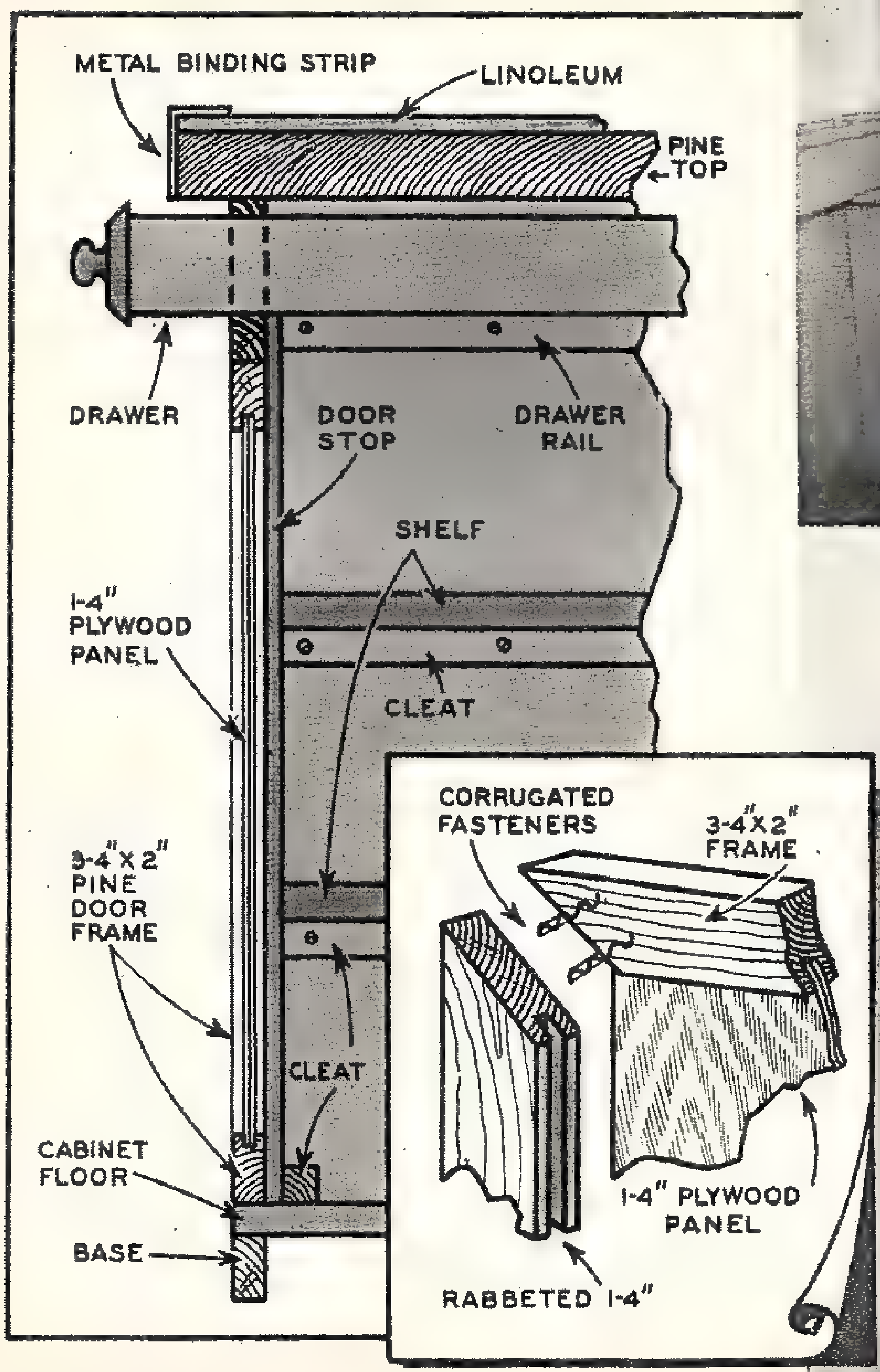
The top is covered with tile-pattern linoleum bound with aluminum or, if you care to go to the extra expense, chromium-plated angle-strip.



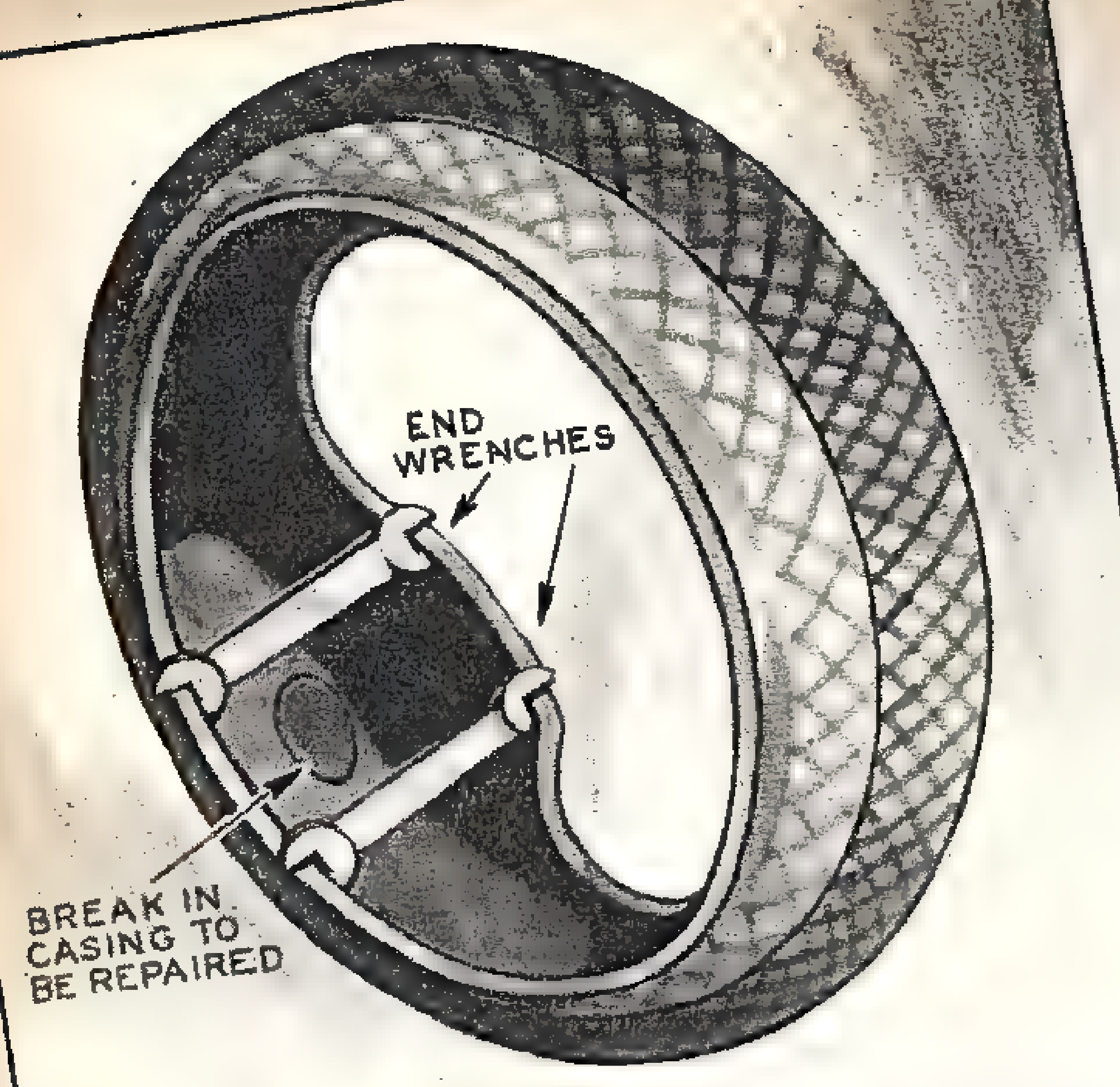


Above—A typical example of outmoded kitchen cabinet and sink in many farm homes. Below is shown the same kitchen after a little work and small amount of material have changed the old style into a kitchen as modern as those in many new homes. While actual placement of original features has not changed, the kitchen as a whole has taken on an entirely new appearance and gives added convenience to the housewife.

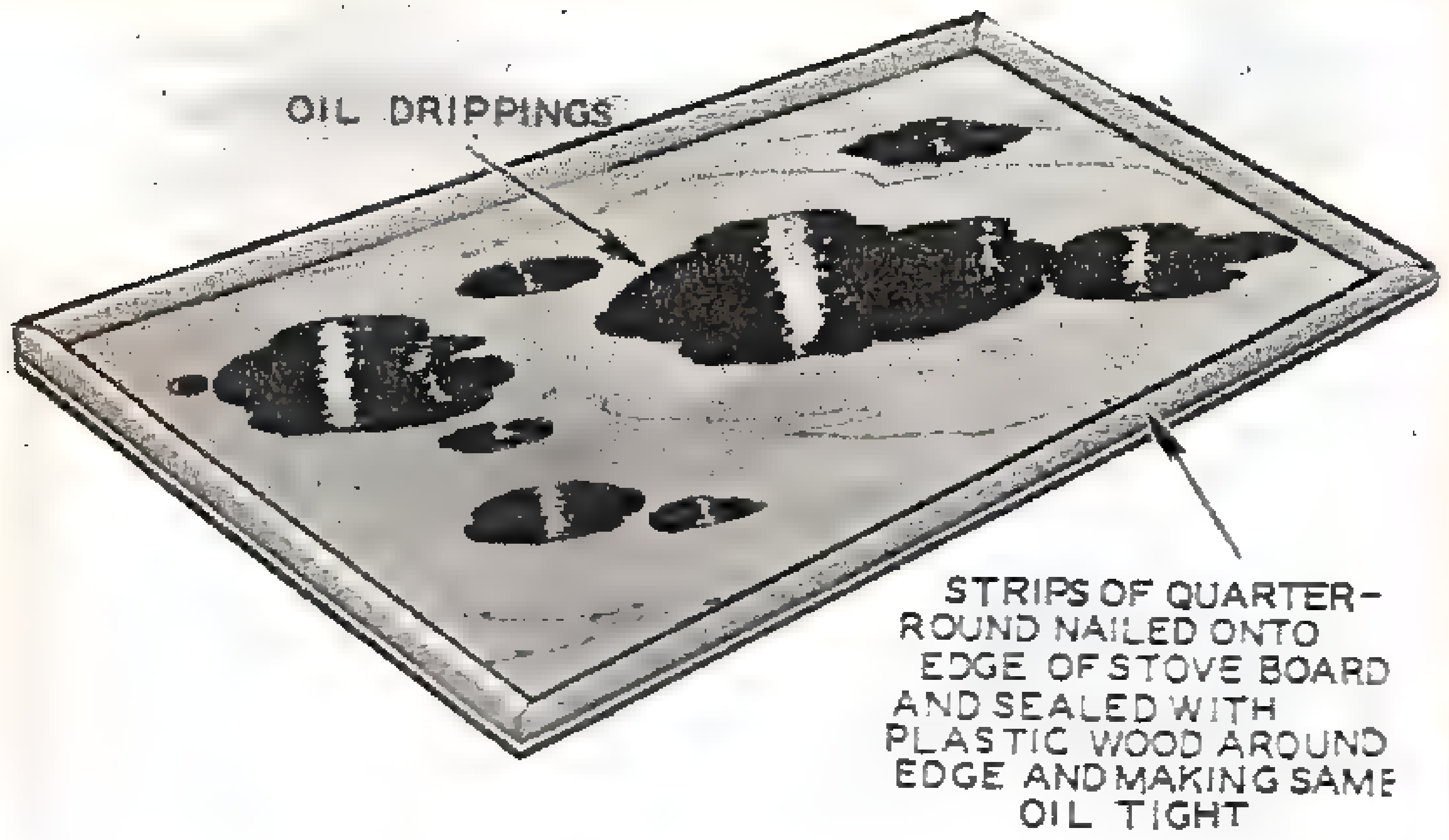



METAL BINDING STRIP
LINOLEUM
PINE TOP
DRAWER
DOOR STOP
DRAWER RAIL
SHELF
1-4" PLYWOOD PANEL
CLEAT
3-4"X 2" PINE DOOR FRAME
CLEAT
CABINET FLOOR
BASE
CORRUGATED FASTENERS
3-4"X2" FRAME
1-4" PLYWOOD PANEL
RABBETED 1-4"

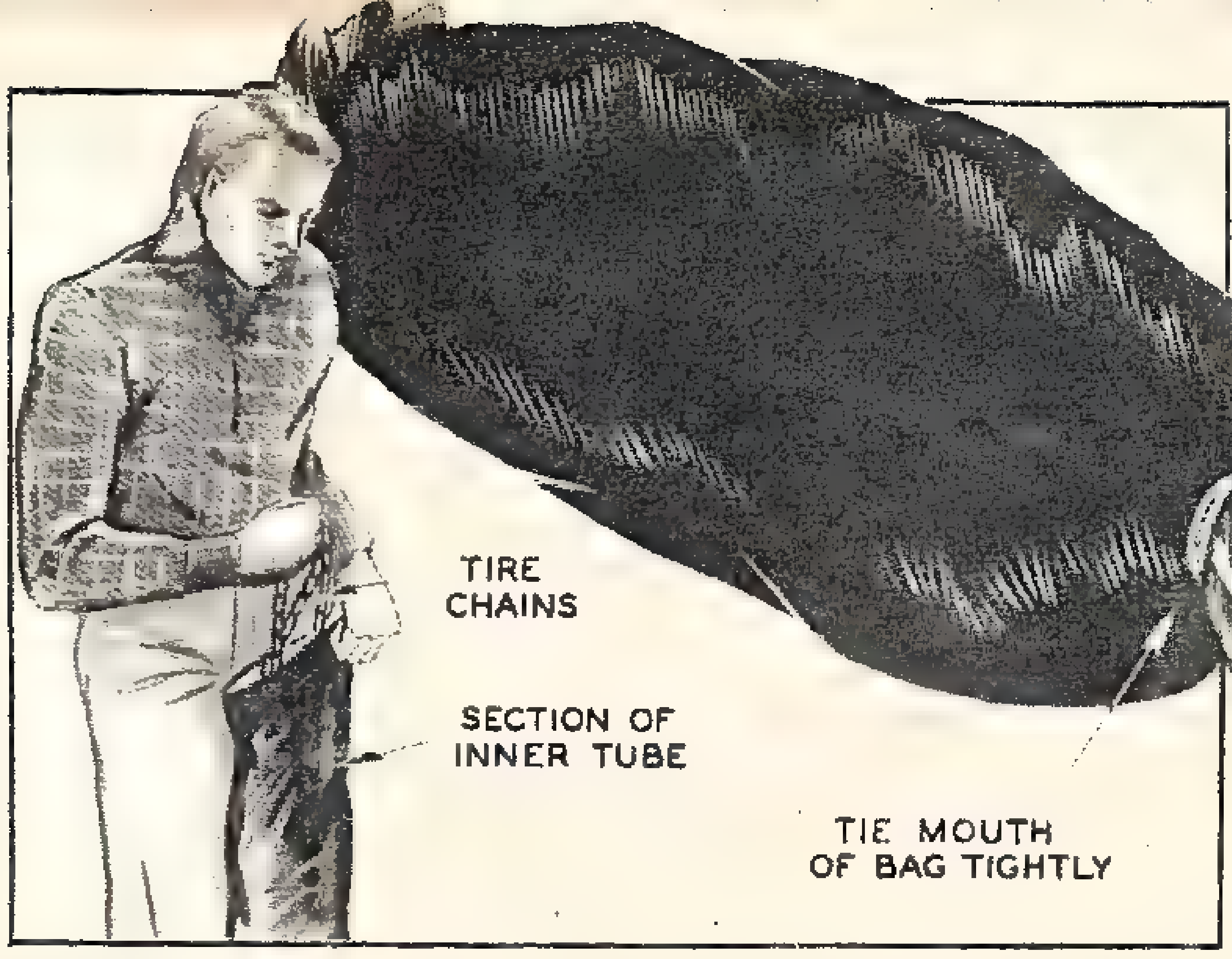
Details of the cabinet construction. Cabinet doors are mitered and secured with casein glue and corrugated fasteners. Although adding to the cost, chromium angle strips will improve the appearance of completed project. Careful drawer construction will prevent sticking and frayed nerves.


END WRENCHES
BREAK IN CASING TO BE REPAIRED

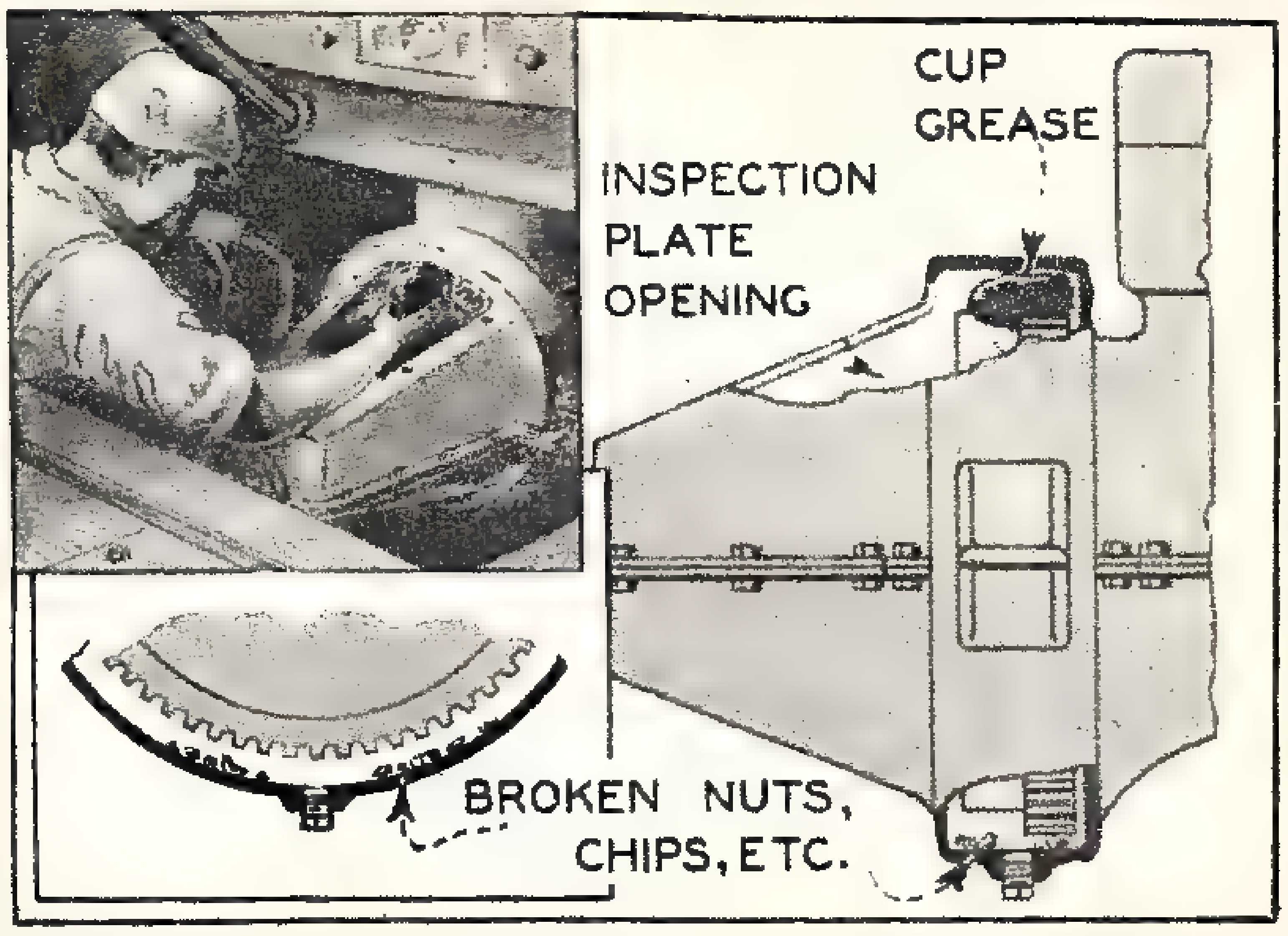
When making repairs to the inside of tire casings, at times it is difficult to keep the beads spread apart far enough to work satisfactorily. By inserting a small endwrench on each side of the portion to be repaired, this difficulty will be eliminated.—Vernon Tracy.


OIL DRIPPINGS
STRIPS OF QUARTER-ROUND NAILED ONTO EDGE OF STOVE BOARD AND SEALED WITH PLASTIC WOOD AROUND EDGE AND MAKING SAME OIL TIGHT

An old stove board makes an ideal drip board for use under a car in a garage. When a quantity of oil has dripped on it, it is a simple matter to wipe it off with a dry rag. If desired, old newspapers can be spread on the board and when they have soaked up all the oil possible, they can be disposed of by burning. Strips of quarter round should be fastened to the edges of the board.—Bob Poulson.


TIRE CHAINS
SECTION OF INNER TUBE
TIE MOUTH OF BAG TIGHTLY

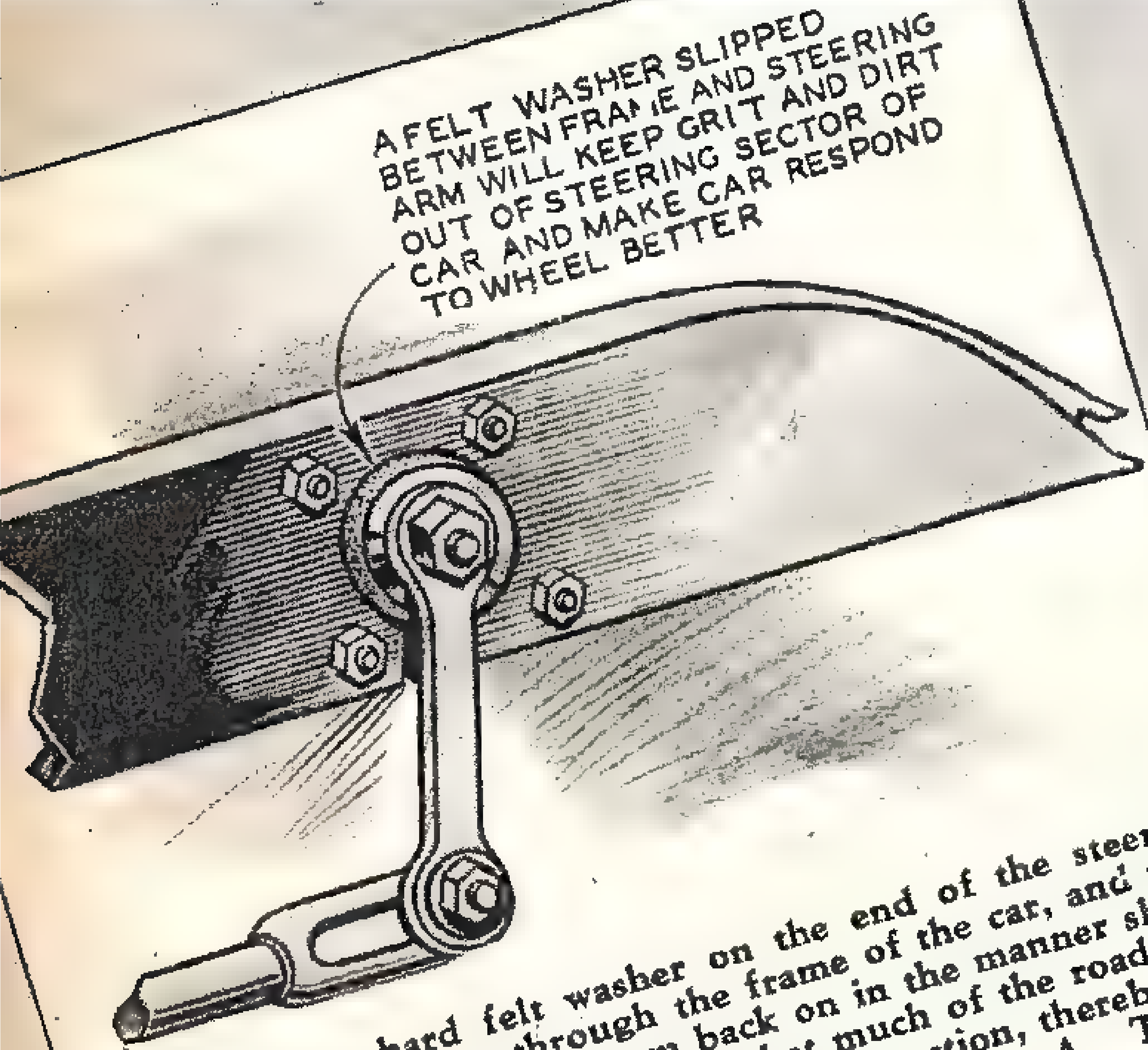
When tire chains are carried in the car, they often cause considerable noise when the car is driven over uneven road surfaces. This noise can be eliminated by carrying the chains in a bag made from an old inner tube.—H. V. Tracy.


CUP GREASE
INSPECTION PLATE OPENING
BROKEN NUTS, CHIPS, ETC.

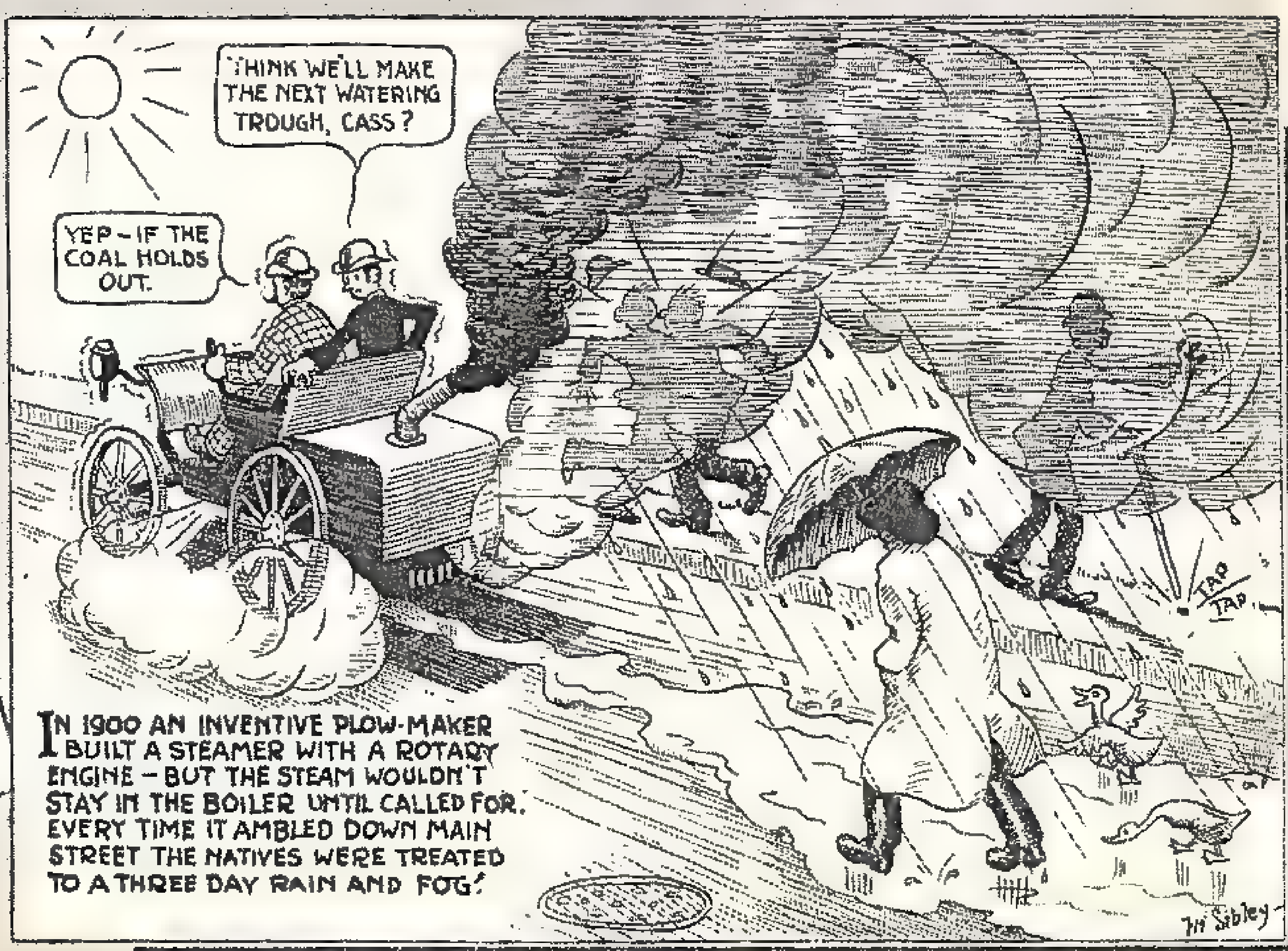
Occasionally broken bolts or small pieces of metal fall into the flywheel housing and are difficult to get out. They can be removed by opening the inspection plate and placing a large lump of cup grease on the flywheel gear. By turning the flywheel slowly the pieces of metal will stick to the grease as it passes around the housing.

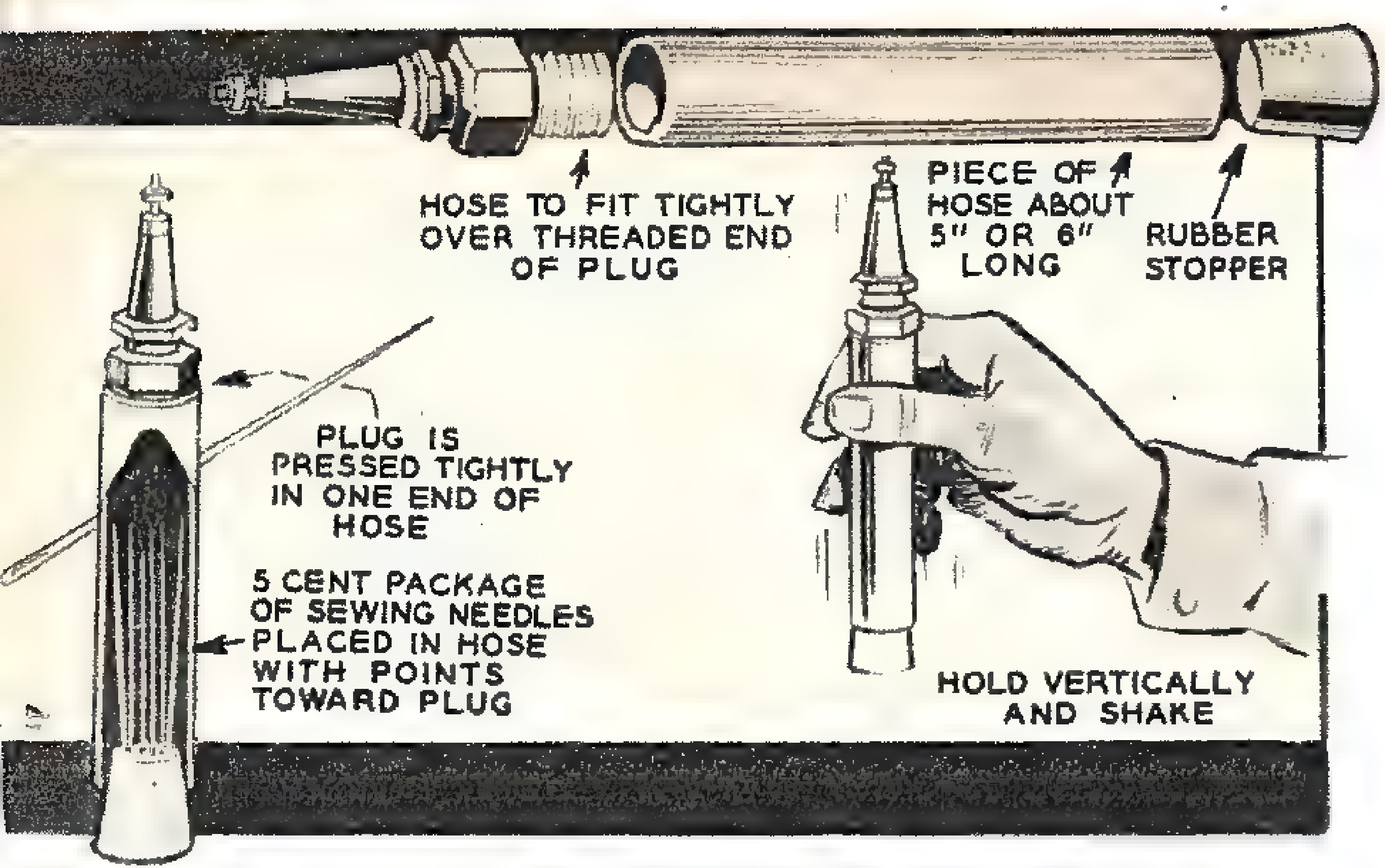
AUTO

"Crankshaft

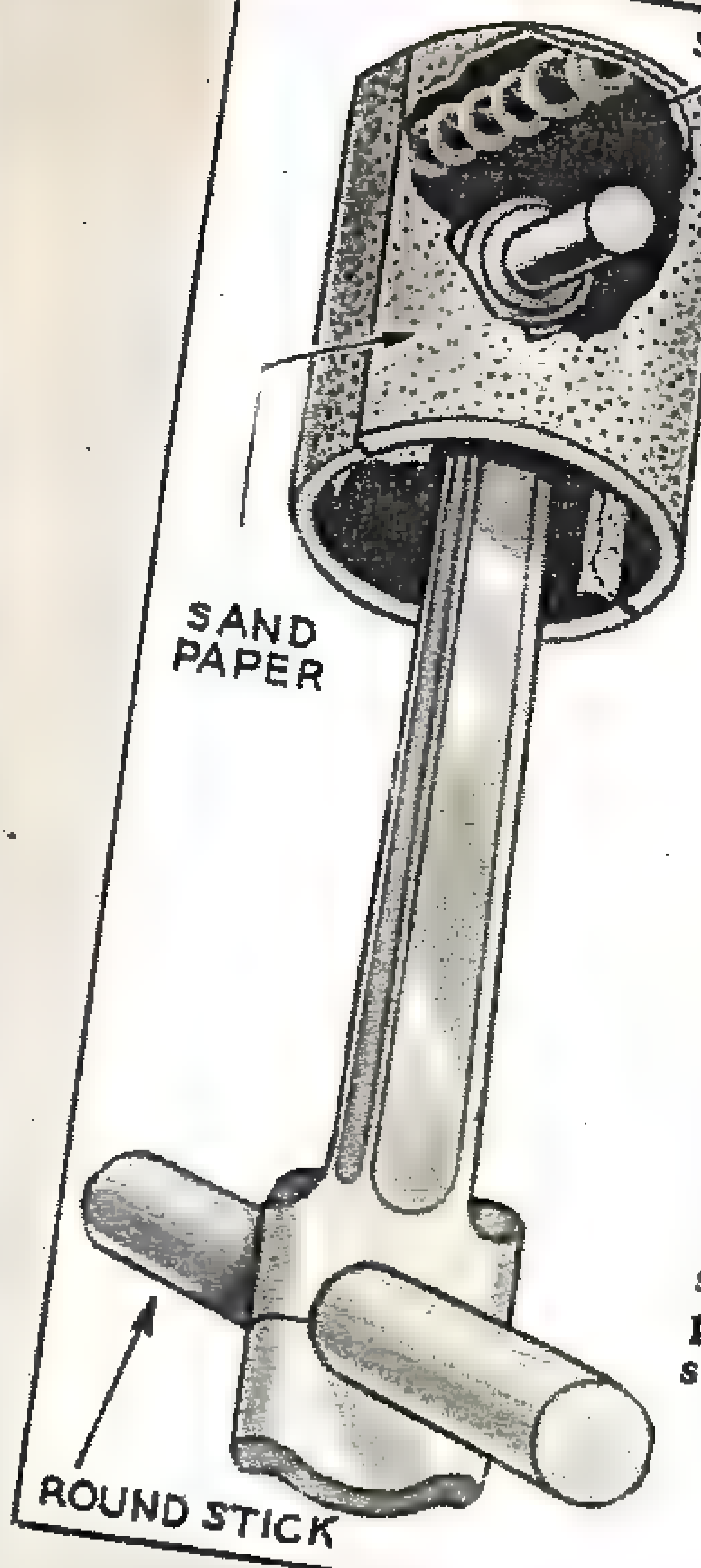

A FELT WASHER SLIPPED BETWEEN FRAME AND STEERING ARM WILL KEEP GRIT AND DIRT OUT OF STEERING SECTOR OF CAR AND MAKE CAR RESPOND TO WHEEL BETTER

By placing a hard felt washer on the end of the steering shaft that comes out through the frame of the car, and then placing the bell crank or arm back on in the manner shown in the drawing, it will be found that much of the road sand and dirt will be kept out of the steering section, thereby permitting the wheels to be turned easier.—A. Tempe.

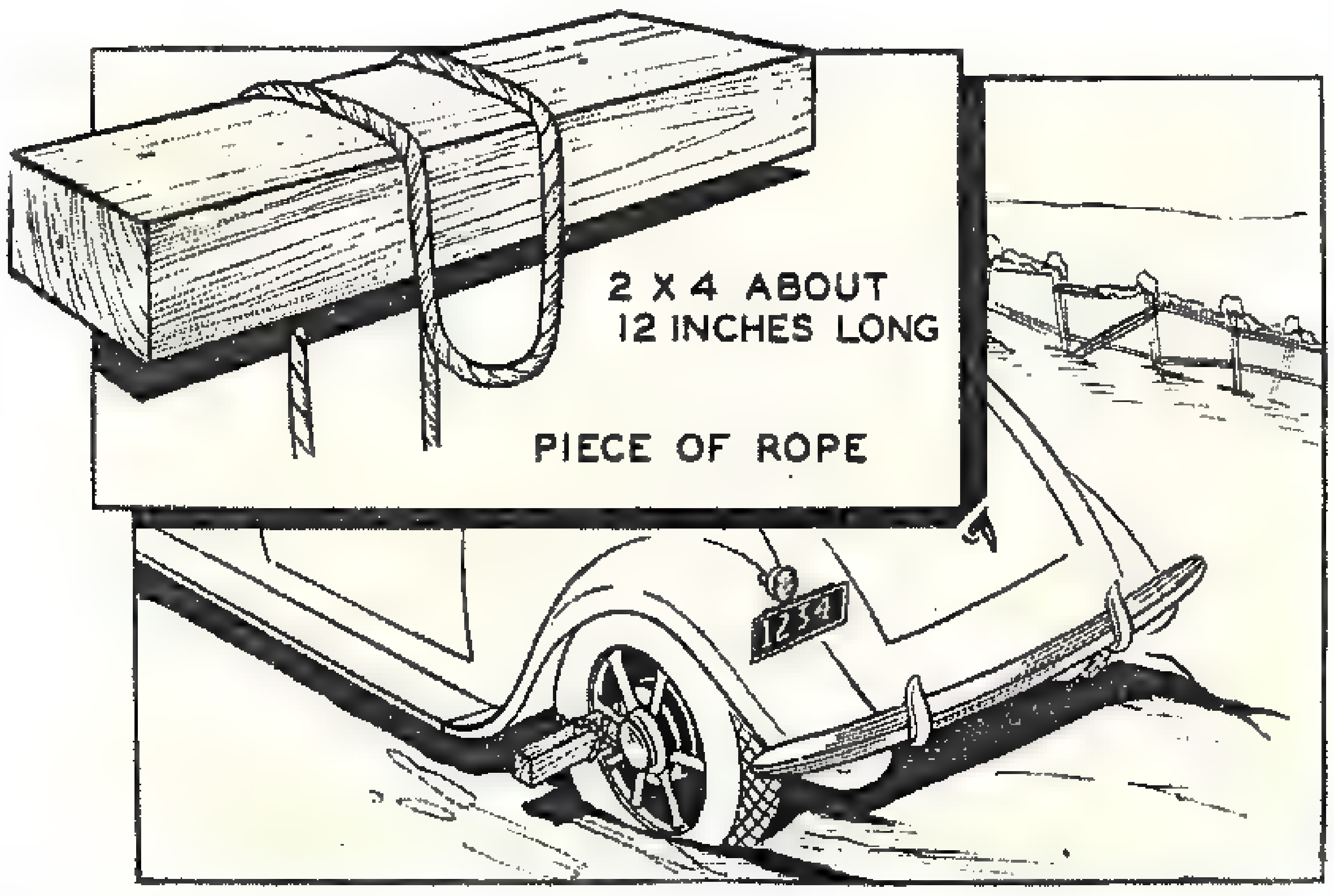

THINK WE'LL MAKE THE NEXT WATERING TROUGH, CASS?
YEP - IF THE COAL HOLDS OUT.
TAP TAP
IN 1900 AN INVENTIVE PLOW-MAKER BUILT A STEAMER WITH A ROTARY ENGINE - BUT THE STEAM WOULDN'T STAY IN THE BOILER UNTIL CALLED FOR. EVERY TIME IT AMBLED DOWN MAIN STREET THE NATIVES WERE TREATED TO A THREE DAY RAIN AND FOG!
Sibley


HOSE TO FIT TIGHTLY OVER THREADED END OF PLUG
PIECE OF HOSE ABOUT 5" OR 6" LONG
RUBBER STOPPER
PLUG IS PRESSED TIGHTLY IN ONE END OF HOSE
5 CENT PACKAGE OF SEWING NEEDLES PLACED IN HOSE WITH POINTS TOWARD PLUG
HOLD VERTICALLY AND SHAKE

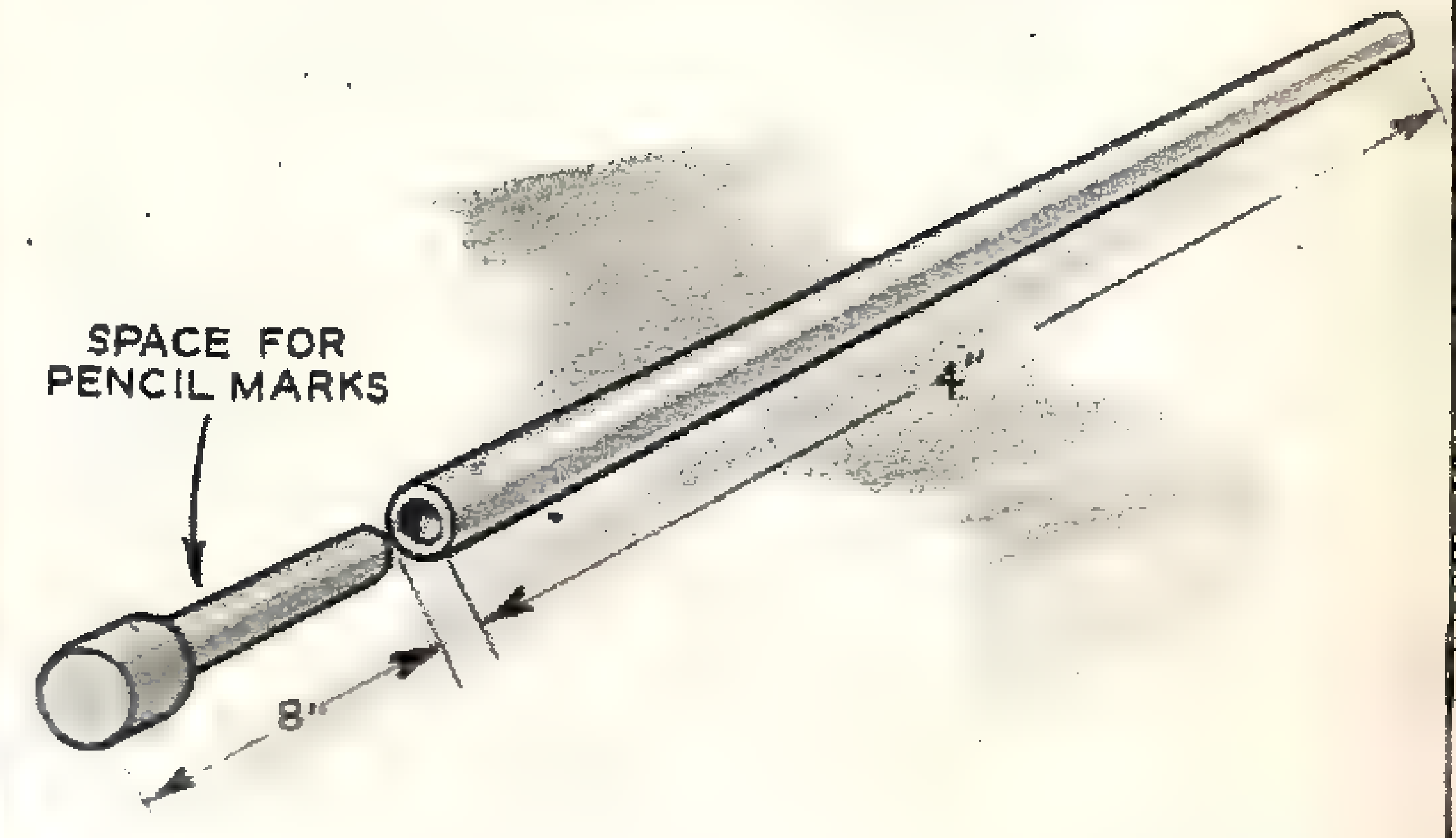
A short piece of hose, a cork and a few needles make a handy and efficient spark plug cleaner. The hose should have a diameter slightly smaller than the spark plug so that it will fit tightly. After the spark plug is in place, put in the needles and cork up to the other end.


SPRING
SAND PAPER
ROUND STICK

On Model A Fords whose cylinders have worn to a cone shape, this device will make it possible to hone down the bottom part so that it will take an oversize piston. A regular size piston should be split as shown in the drawing. Cover each side with emery cloth and insert one or two springs inside the piston so that they will exert their force to open it. When inserted in the cylinder, a rotary motion will bring it to the desired size. This method also can be used on other car engines when the cylinder size is to be increased. The worker should exercise caution to prevent more than the desired enlargement.—A. C. Hill.


2 X 4 ABOUT 12 INCHES LONG
PIECE OF ROPE
1234

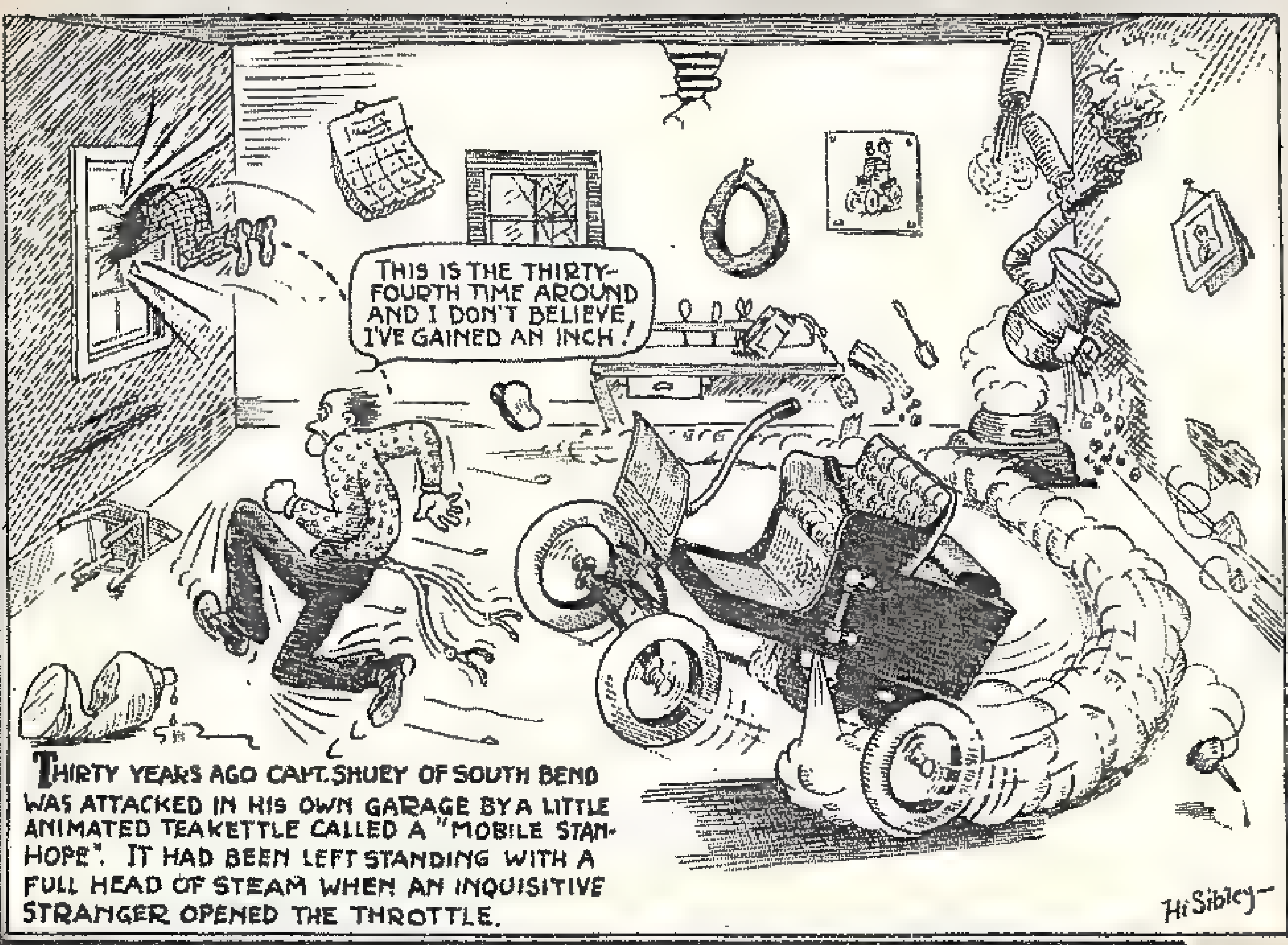
A 2 by 4 fastened to the rear wheels of a car as shown in the drawing will greatly speed the process of freeing a car when it is in a sand or mud hole. When starting be sure to do it slowly so that the wood will not strike the fender.—A. H.


SPACE FOR PENCIL MARKS
4'
8'

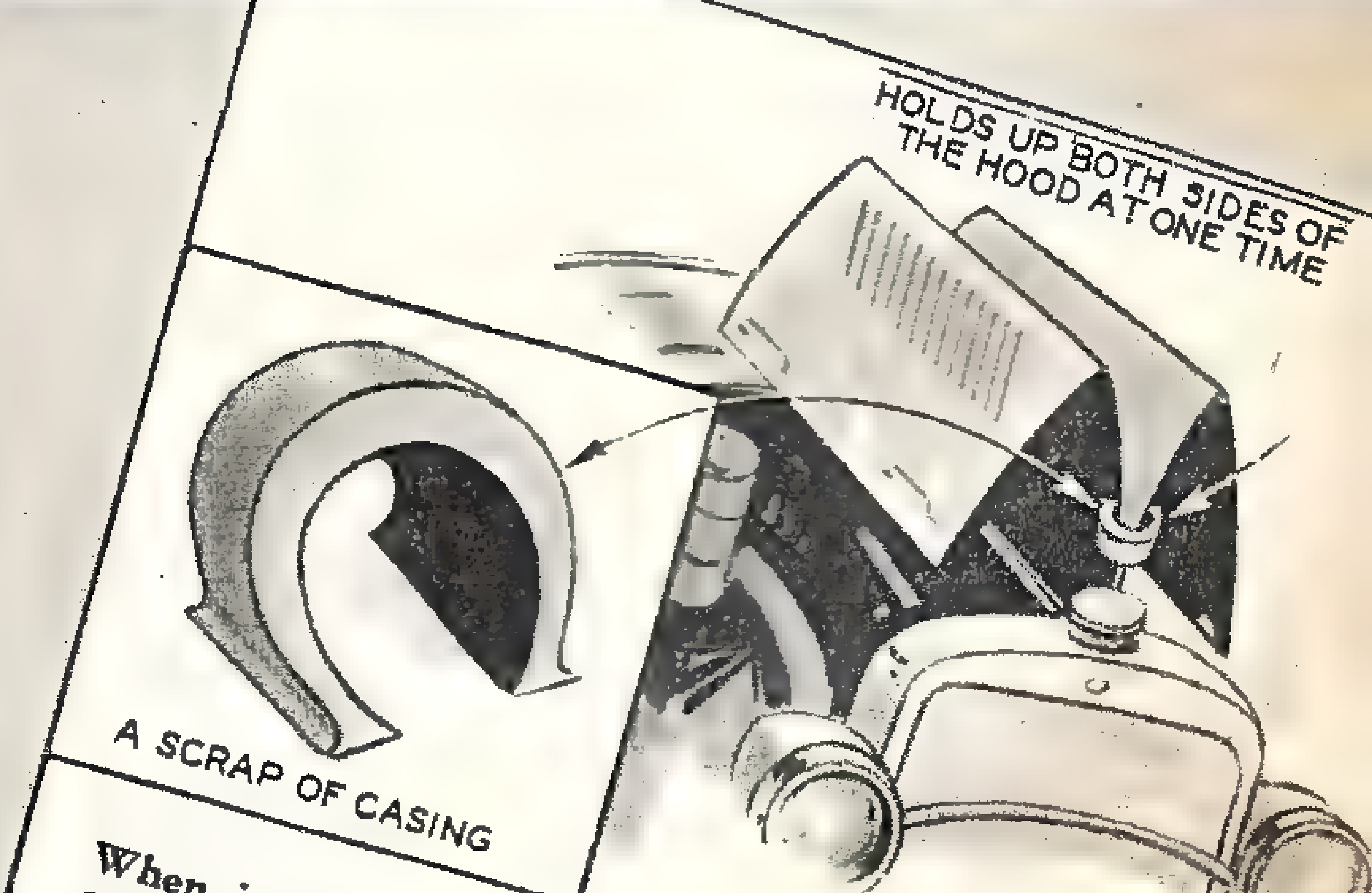
The drawing shows a home-made measuring stick for measuring the toe-in of an automobile. Two wooden curtain rollers are spliced together. One end is cut square. A piece of wood is shaped as shown in the drawing, for the other end, from which the spring is removed. The small piece should be free to move in or out of the long strip, and can be marked when toe-in is checked.—A. C. Hill.

KINKS

Chronicles"


THIS IS THE THIRTY-FOURTH TIME AROUND AND I DON'T BELIEVE I'VE GAINED AN INCH!
Hi Sibley

THIRTY YEARS AGO CAPT. SHUEY OF SOUTH BEND WAS ATTACKED IN HIS OWN GARAGE BY A LITTLE ANIMATED TEAKETTLE CALLED A "MOBILE STANHOPE". IT HAD BEEN LEFT STANDING WITH A FULL HEAD OF STEAM WHEN AN INQUISITIVE STRANGER OPENED THE THROTTLE.


HOLDS UP BOTH SIDES OF THE HOOD AT ONE TIME
A SCRAP OF CASING

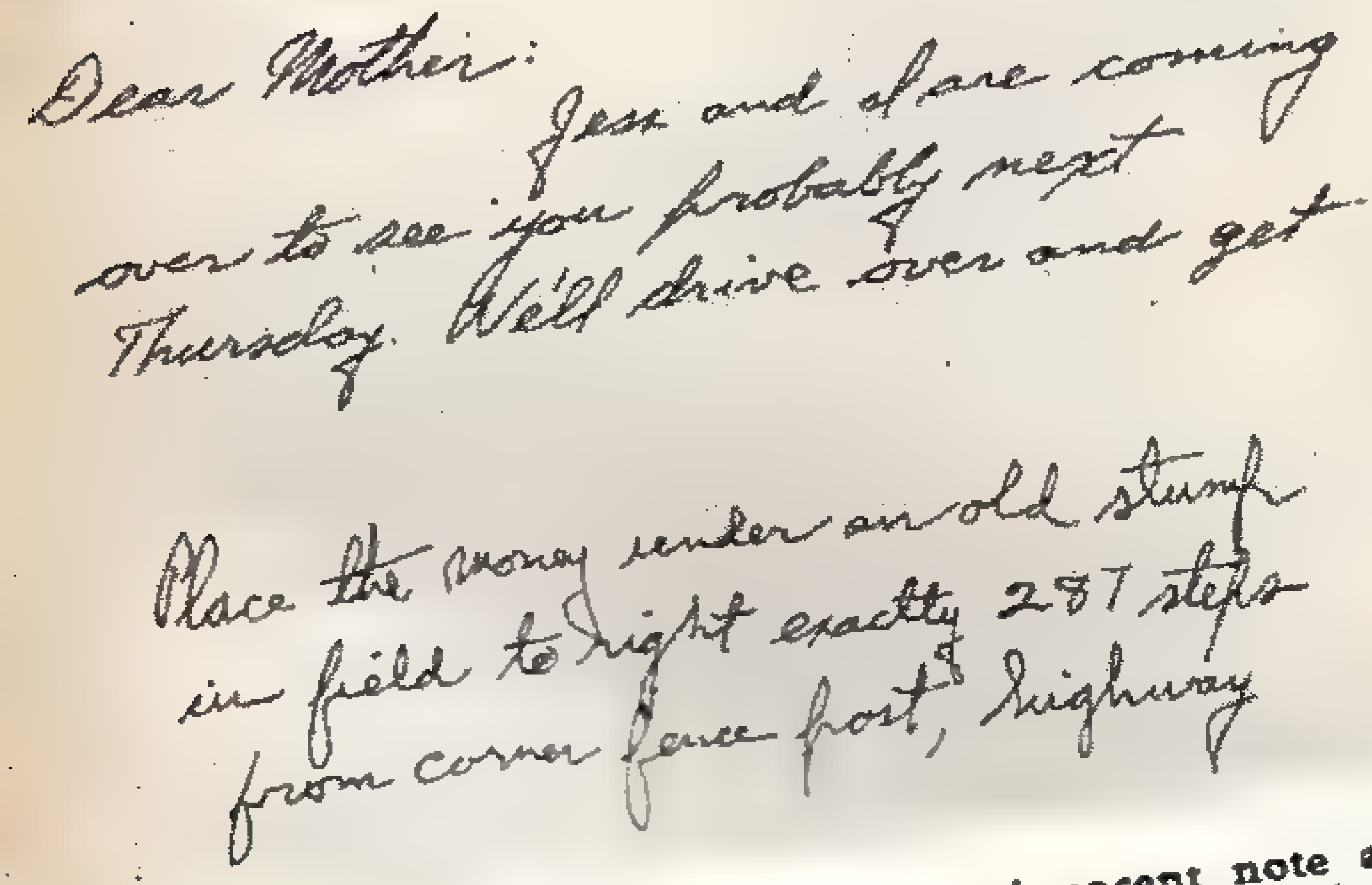
When it is necessary to hold an engine hood up as high as possible to be out of the way while working on the engine, a small piece of tire casing will be found satisfactory. If the hood is heavy, two pieces, one at each end, probably will be necessary.—A. H. Waychoff.

by Julian D. Corrington, Ph. D.

The microscope shows glaring differences while naked eye sees duplicates.

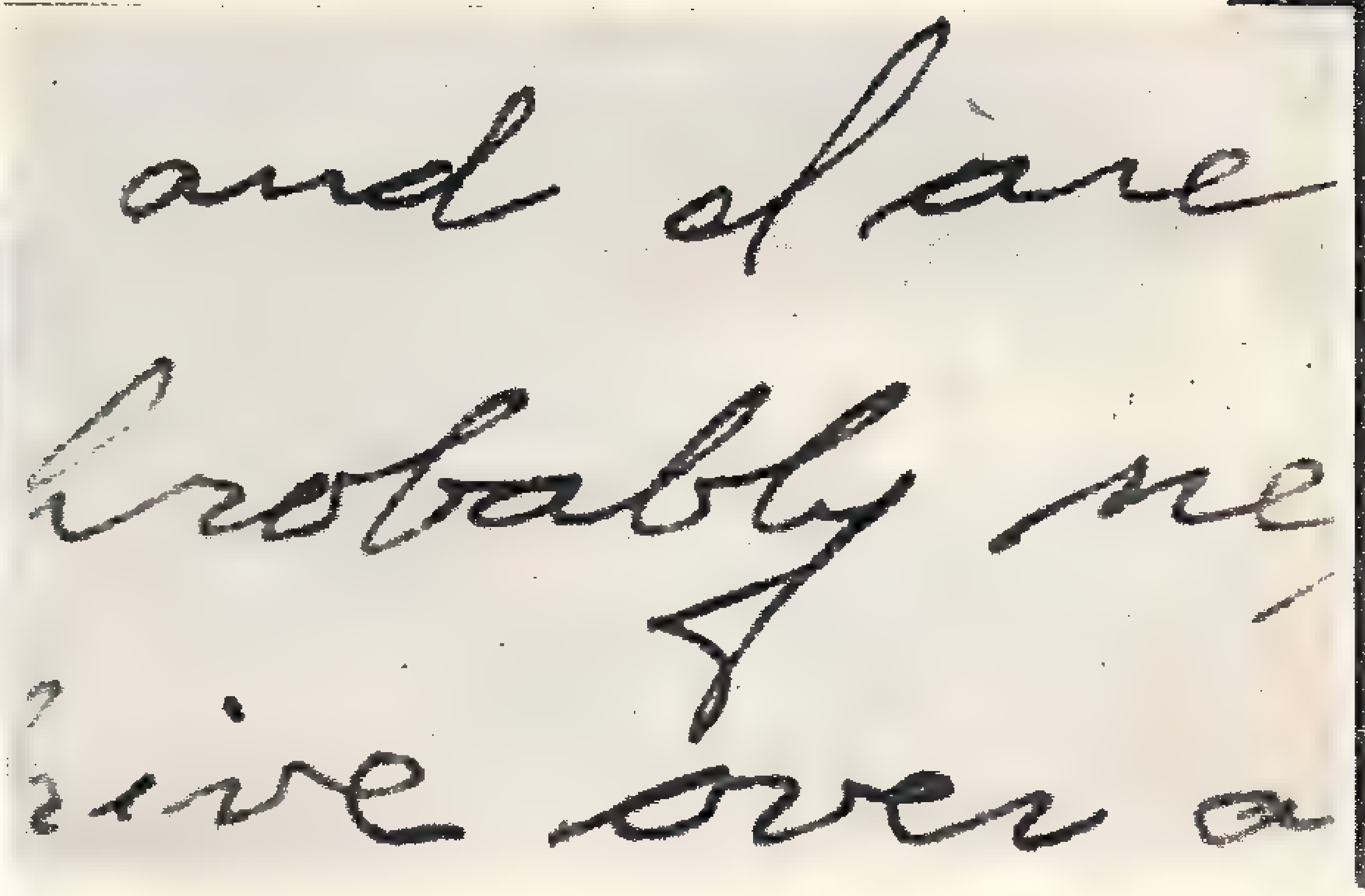
DOCUMENTARY

A binocular microscope in use at the sheriff's office, Bakersfield, Calif. Under the camera is a fingerprint record. Double microscope in center is for bullet comparison.



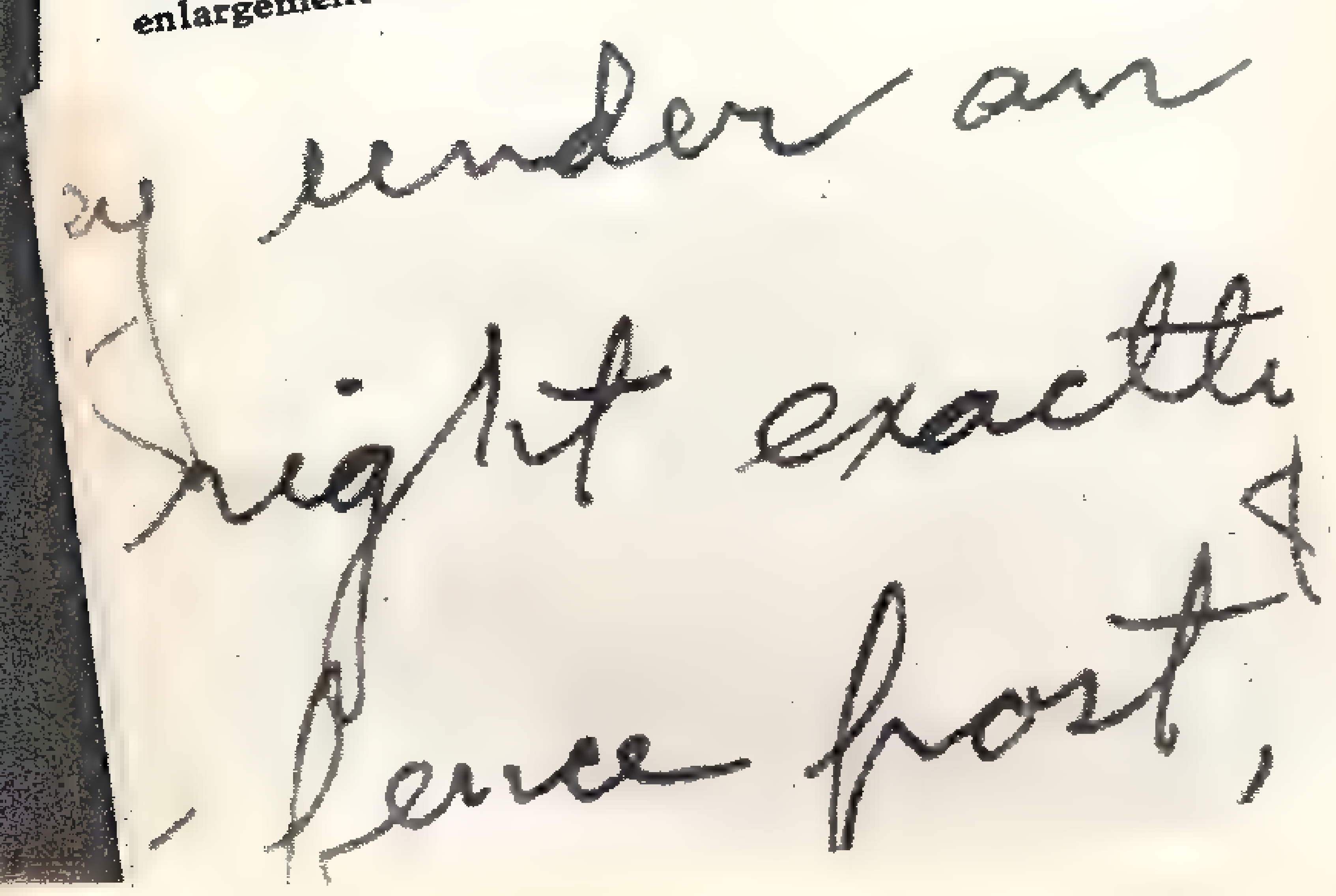
Dear Mother:
Jess and I are coming
over to see you probably next
Thursday. We'll drive over and get

Place the money under an old stump
in field to right exactly 287 steps
from corner fence post, highway



and I are
probably ne
ive over a

Samples of handwriting showing an innocent note and the same person's handwriting when an attempt is made to disguise it. Below is an enlargement of the disguised sample showing similarities to the innocent note. At right is an enlargement of writing when no disguise was attempted.

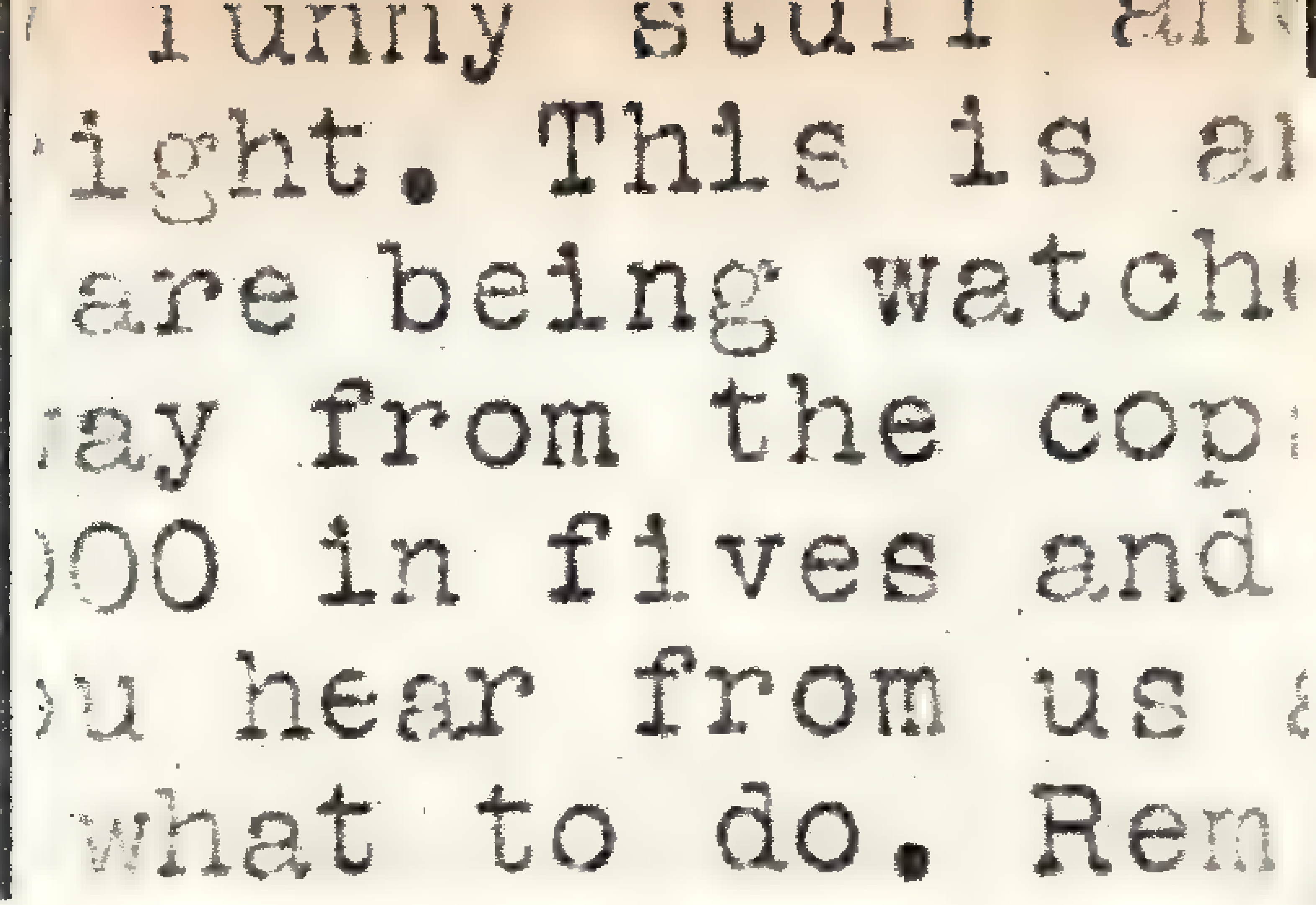


y under an
right exactl
fence post,

SUPPOSING you had done a successful job of kidnaping—successful, that is, up to the point where you were about to sit down and write the note demanding ransom. How would you go about this ticklish part of the procedure? Would you write it out longhand, print it by hand, or use a typewriter?

If you were very, very stupid, as so many criminals are, you might not even give a thought to this part of the business, or might conclude that the police could not possibly be smart enough to trace your handwriting; in either case you would be likely to write or print as best your limited education permitted. If you were a trifle less stupid but still far from wise, you might decide that handwriting is a give-away but that anonymity resides in the typewriter, and hence you would use such a machine should you have access to one. The really intelligent malefactor knows that, as a matter of fact, it actually doesn't make any difference—the scientific detective can easily trace any of the three forms of communication.

Documents comprise one of the major divisions in modern crime detection—a subject introduced in the preceding installment (in the March, 1938 issue) by detailing the fingerprint system of personal identification. There are still other chapters in criminology that are fascinating, but scarcely any more interesting than that having to do with tracing and identifying all forms of written or printed material, and entering nearly every type of crime from homicide and kidnaping through embezzlement and forgery to blackmail and poison-pen letters. We all get a big kick out of newspaper accounts telling how



funny stuff an
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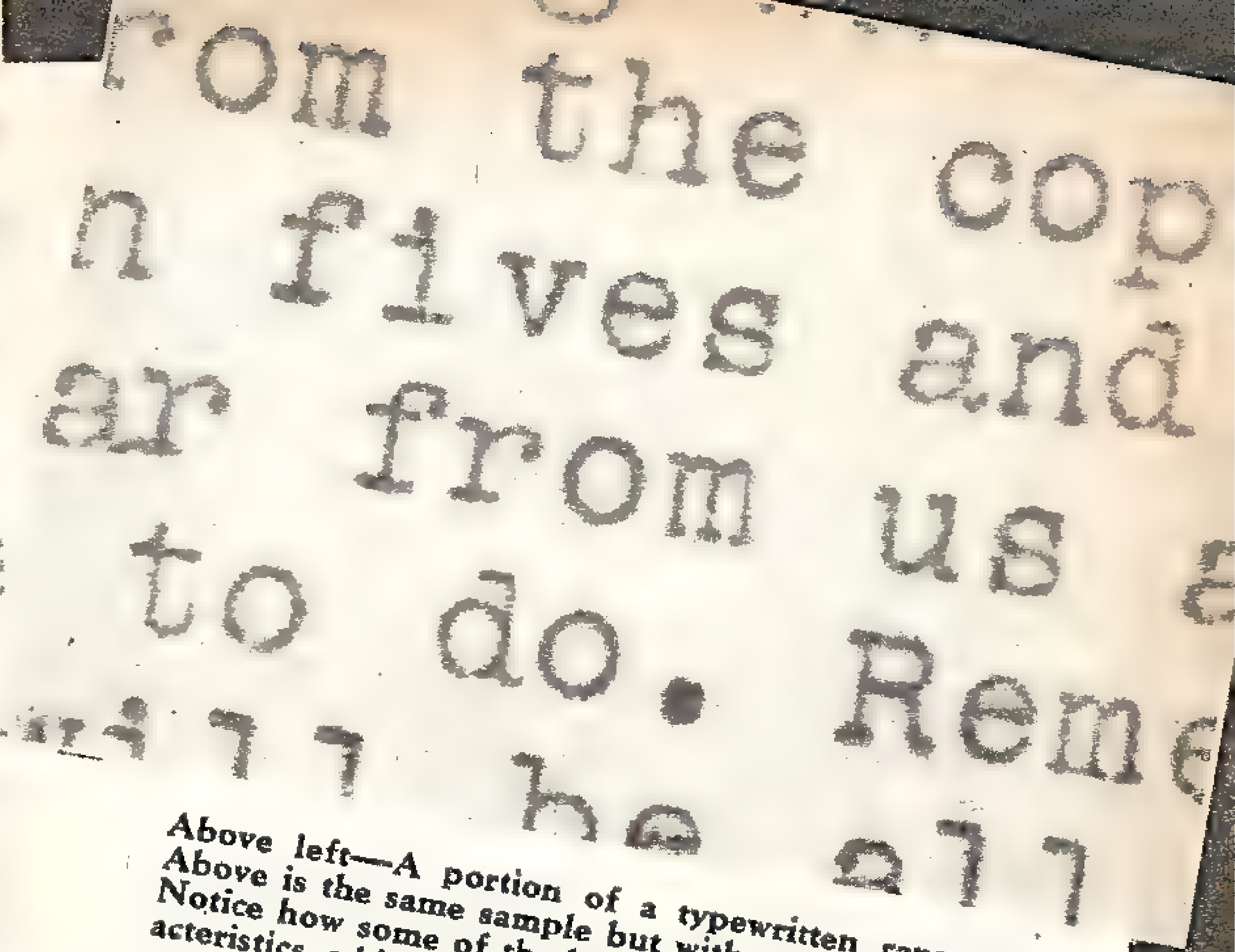
u hear from us
what to do. Rem



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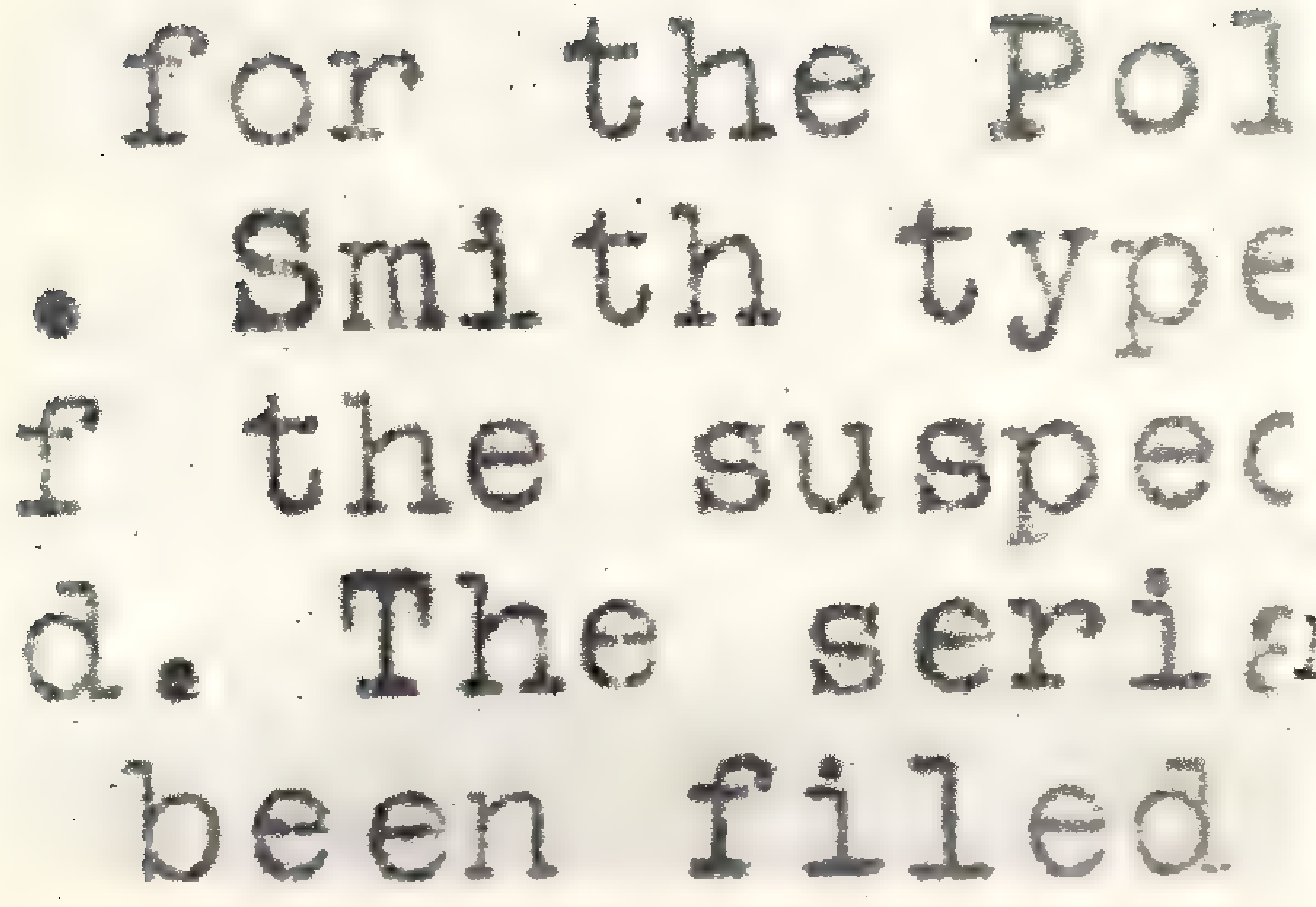
EVIDENCE

Above left—A portion of a typewritten ransom note. Above is the same sample but with greater enlargement. Notice how some of the letters have distinguishing characteristics which show up clearly under magnification.



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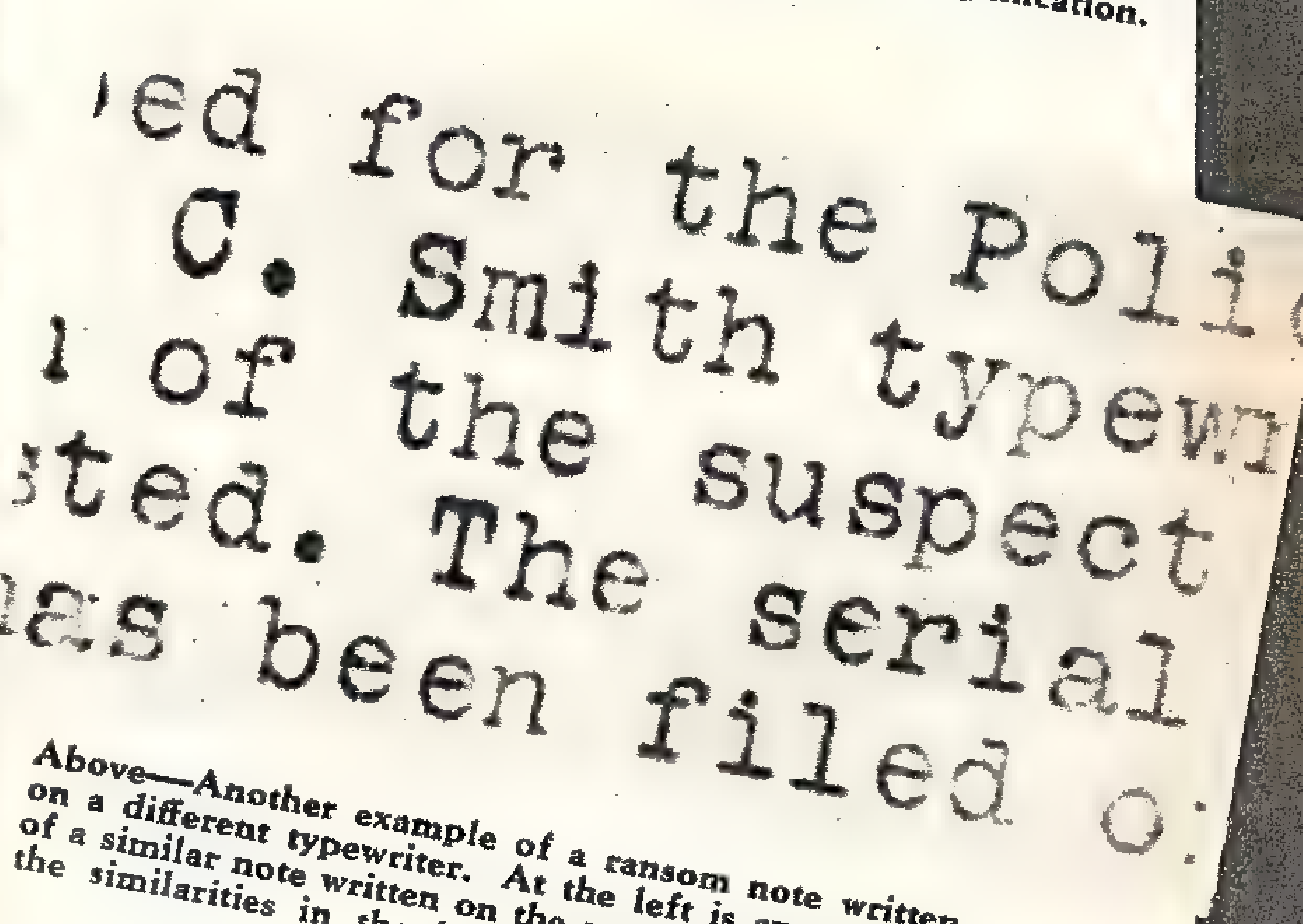

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C. Smith typewr
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as been filed o

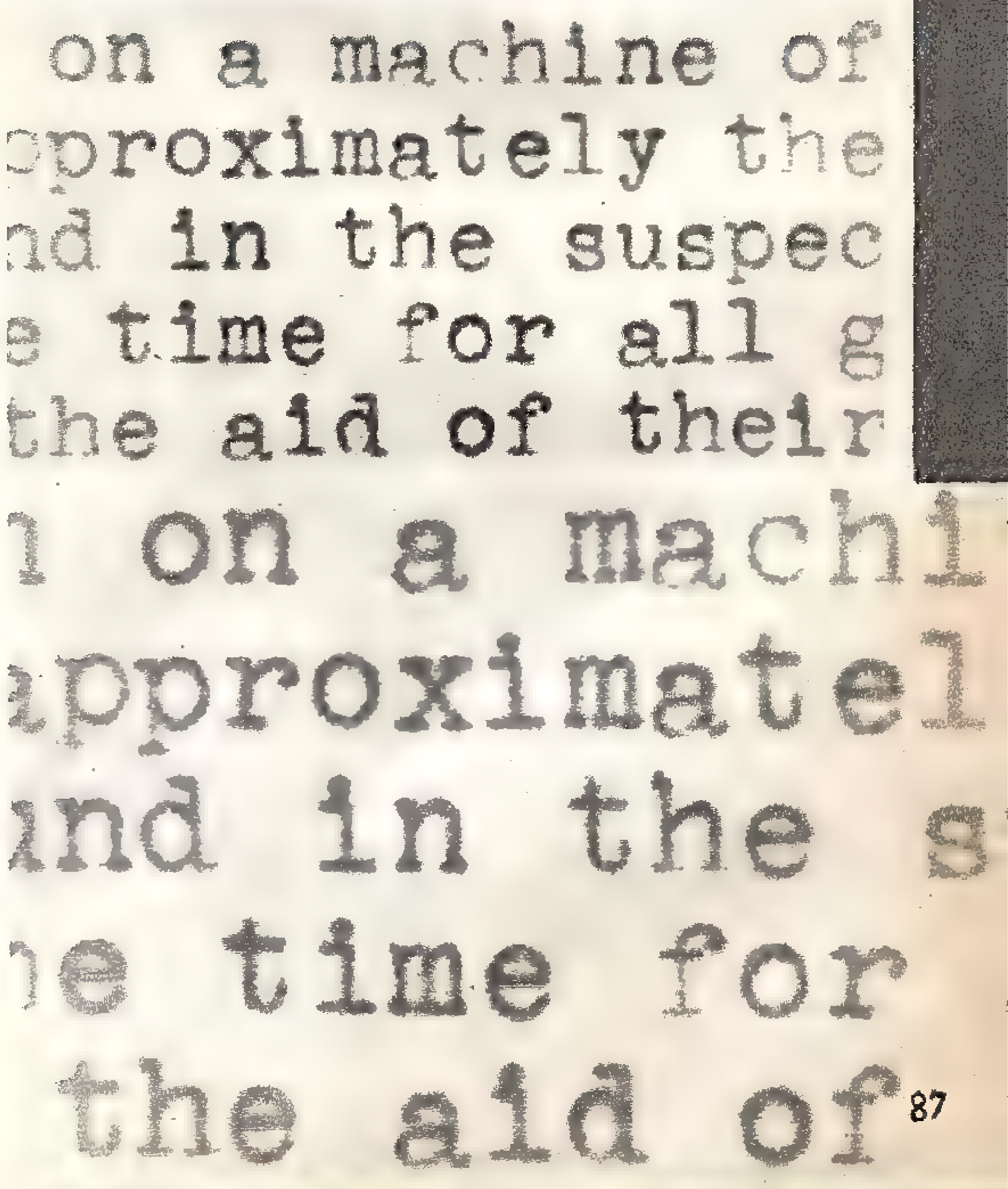
Above—Another example of a ransom note written on a different typewriter. At the left is an example of a similar note written on the same machine. Note the similarities in the letter "e" in both samples.

G-men traced a ransom note or ran down a notorious band of counterfeiters. Just how are these marvels of scientific sleuthing accomplished, and can we perform some experiments with our own microscopes that will simulate real cases and teach the methods?

Many channels of communication are open today, but handwriting is still one of the chief resorts of the criminal and its study forms a necessary part of training in criminology. It would be out of place here to describe individual traits of penmanship, but aside from constant differences in the shaping of separate letters, there are characteristic methods of spacing, punctuation, sentence formation, choice of words and the like that are as diagnostic as the Bertillon system of physical measurements.

Most of these points are discernible with the unaided eye, but low-power magnification—as with a reading glass, fingerprint reader, hand lens or binocular microscope—brings out the differences much more forcefully. Such aids to vision are constantly in use in examining documents and those who wish to study applications of the microscope

Below—An enlargement of the work of a machine having clear individual characteristics. Note top of letter "a." The line is unusually heavy. Also, the dot on the "i" runs into body of letter. Bottom—Same sample, greater enlargement.



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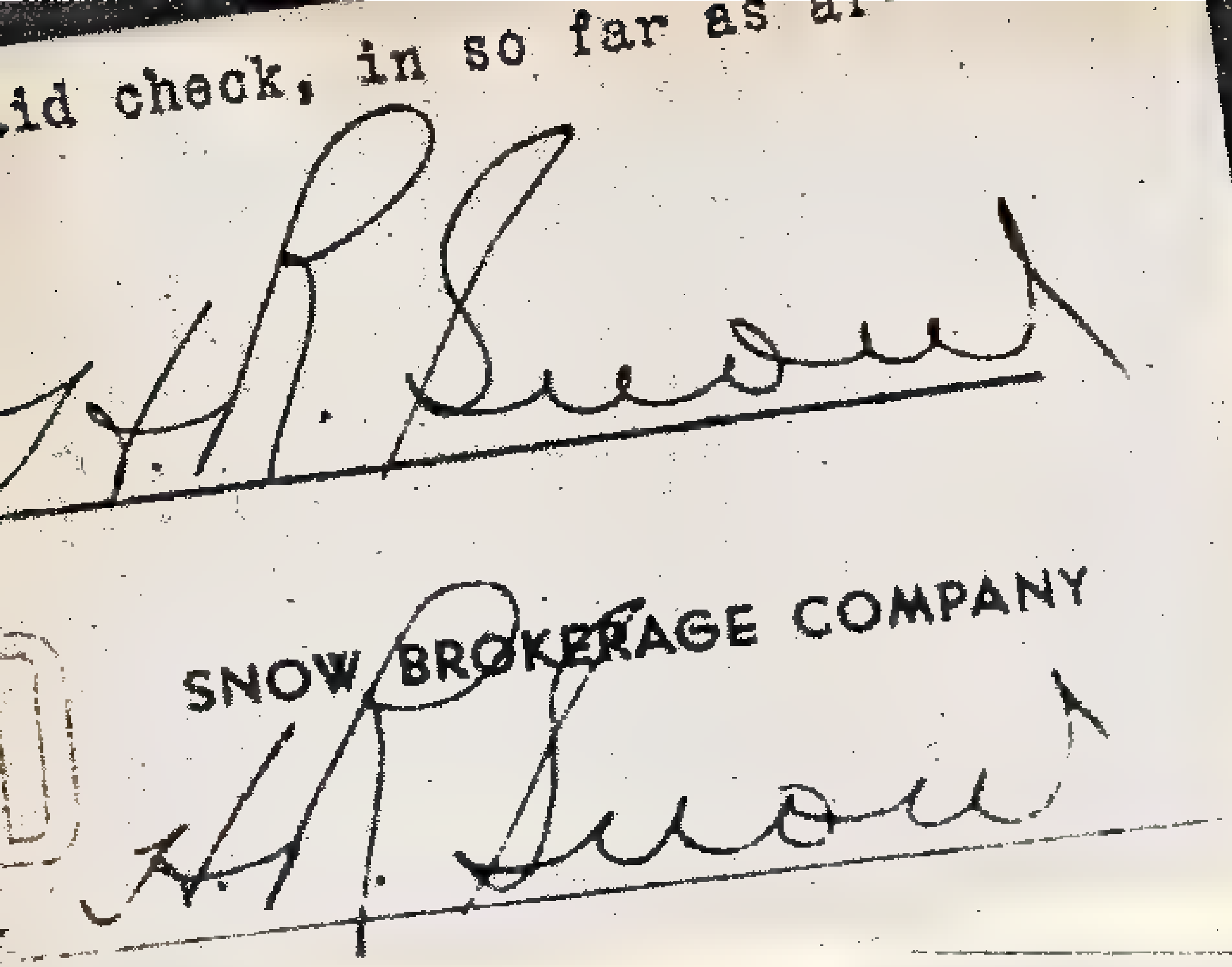


id check, in so far as a

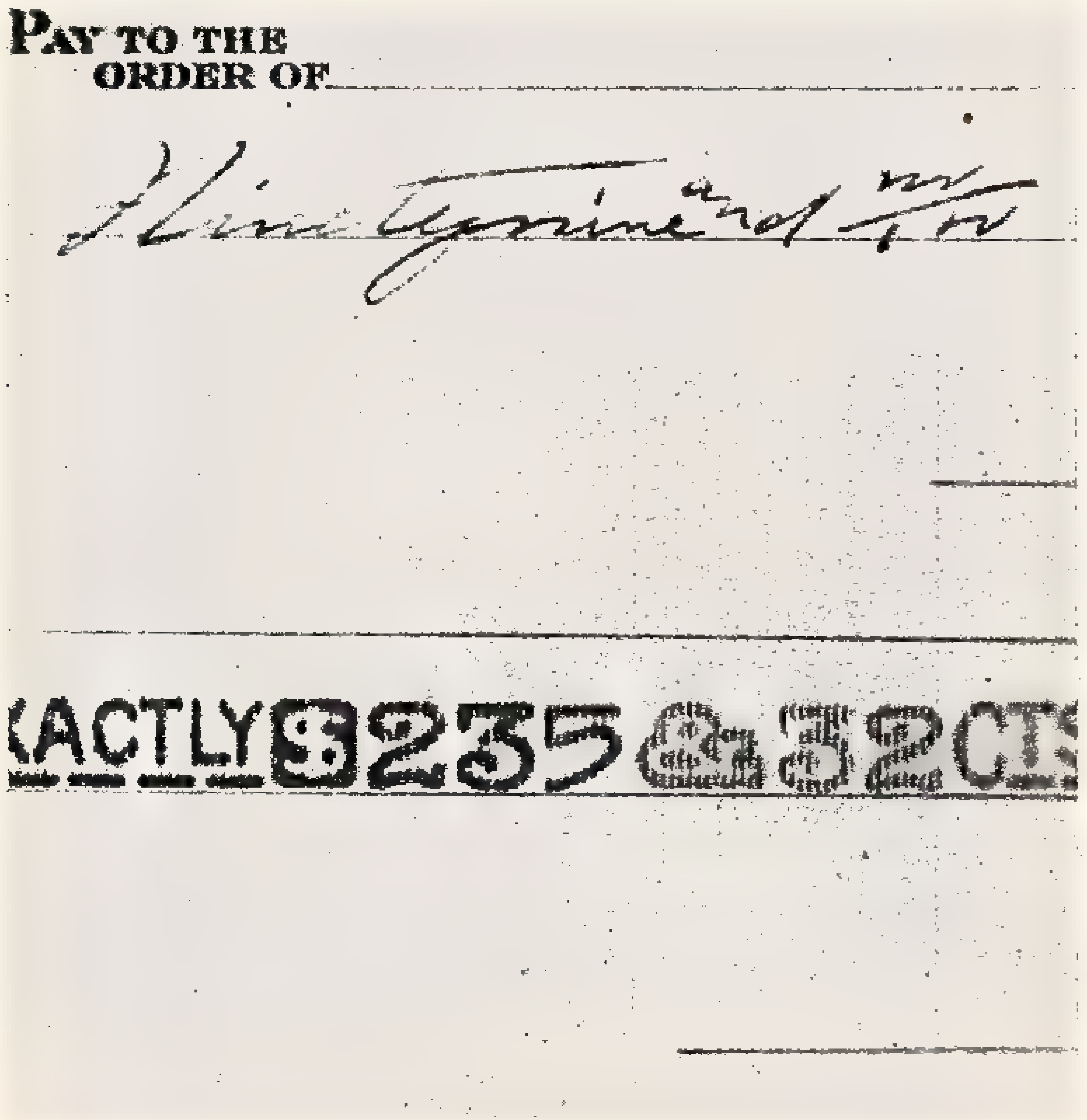
SNOW BROKERAGE COMPANY

H. R. Snow

H. R. Snow

Above—The top signature is an enlargement of an original, while the lower one is an enlargement of the same signature when an attempt was made to reproduce it by another person. Note the differences in letters "n" and "o." Right—Example of a raised check. Below — A mechanical check writer is protection against check raising.

At the right is a chart of pen changes. Dotted lines indicate additions made to raise various amounts. Note the very slight addition necessary for raising two thousand to five thousand.



PAY TO THE ORDER OF

Ninety nine and no/100

ACTLY $235 & 32 CTS

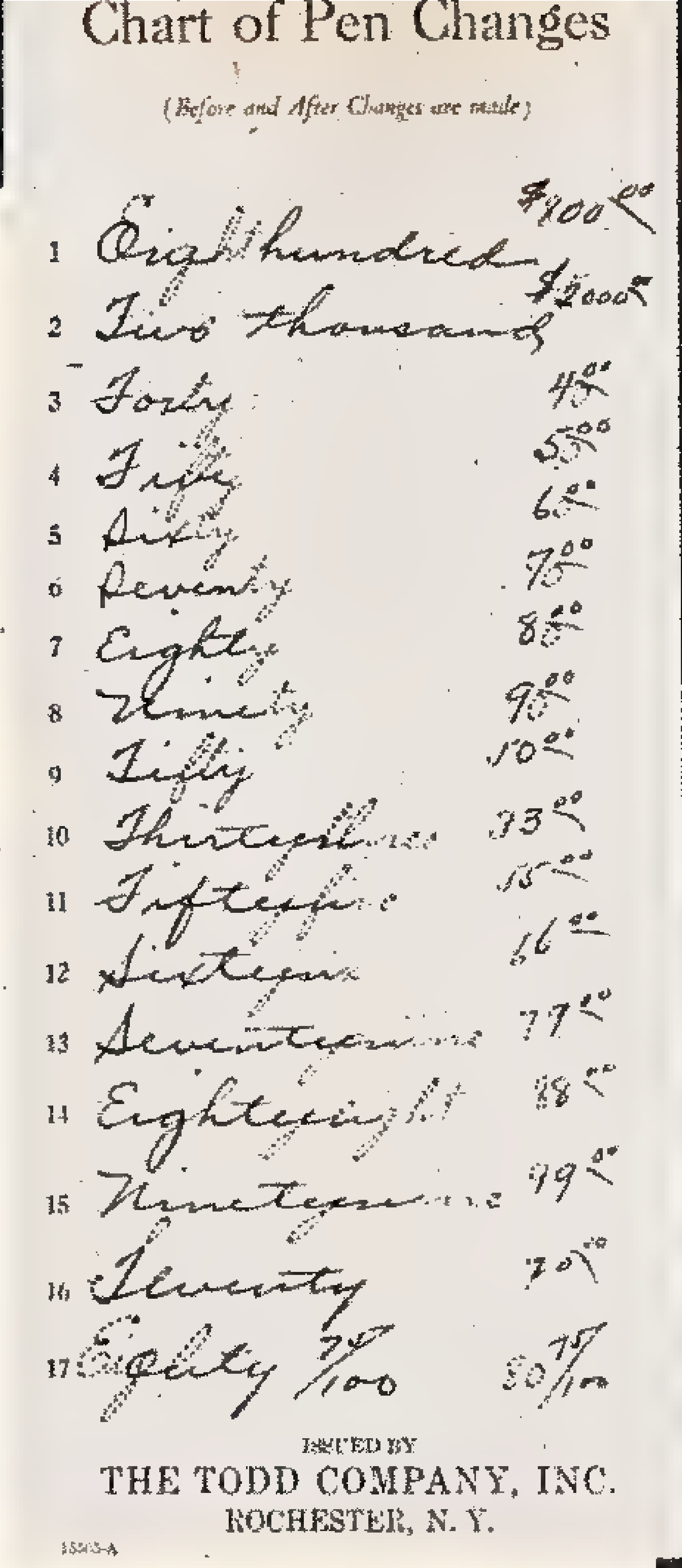


Chart of Pen Changes

(Before and After Changes are made)

1	Eight hundred	$800.00
2	Two thousand	$2000.00
3	Forty	45.00
4	Fifty	55.00
5	Sixty	65.00
6	Seventy	75.00
7	Eighty	85.00
8	Ninety	95.00
9	Fifty	10.00
10	Thirty three	33.00
11	Fifteen	15.00
12	Sixteen	16.00
13	Seventeen	77.00
14	Eighteen	88.00
15	Nineteen	99.00
16	Seventy	70.00
17	Eighty 77/100	80 77/100

ISSUED BY
THE TODD COMPANY, INC.
ROCHESTER, N. Y.

to criminology should provide themselves with some form of simple magnifier in addition to a compound microscope. The low-power or projection eye-piece in an ordinary compound microscope is also to be recommended.

A favorite method of enlarging handwriting as well as other forms of documentary evidence is by projection. The old-fashioned "magic lantern" and its modern improvement, the projection machine or lantern, are both actually microscopes in that they employ lenses to produce a magnified image. They differ from ordinary microscopes in that they throw their images upon a screen or wall instead of upon the retina of the eye.

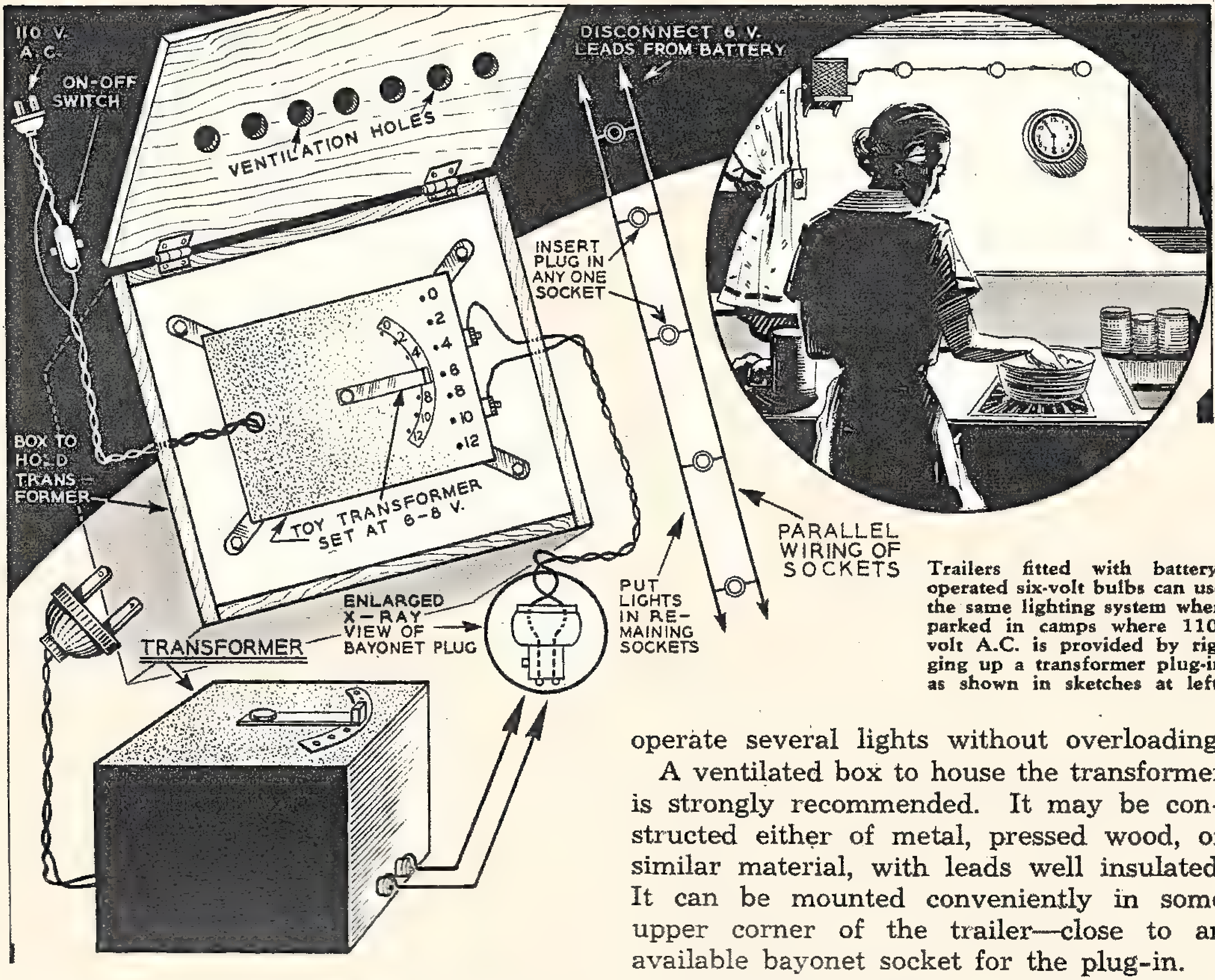
Two choices of projection method are open. In one the original document—for example, a letter written on ordinary paper in ink—is placed in an instrument known as an opaque projector. Brilliant illumination from a 500-watt lamp plays upon the sheet, held flat on the bottom tray of the machine; the reflection is picked up by a mirror and sent through a lens which focuses it upon the distant screen, greatly enlarged. This is the system of reflected light. In the second method, a photograph is taken of the original and a positive print made on glass as a transparency, the image then being produced by transmitted light as with any form of lantern slide, and thrown thence to the screen. Small details stand out conspicuously, and comparisons are readily made. Such exhibits are frequently brought into court as evidence. As an experiment, write out a paragraph of material of any nature and ask a dozen of your friends or associates to copy it in their own handwriting, placing their names on the backs of the cards. After studying these samples carefully with a reading glass until you have made out the chief individual characteristics, have some one of the group, identity unknown to you, write another card, a short sentence this time, and see whether or not you can pick out the author by a comparison of the features. Practice and study of this sort places one on the road to becoming a handwriting expert, and is an amusing game.

As shown by accompanying illustrations, attempts to disguise one's proper handwriting are not successful, since many inherent traits will crop out in spite of all that one can do.

Even greater interest results, however, when one person attempts to imitate another's handwriting. More often than not, this effort is limited to

[*Continued on page* 122]

Transformer Simplifies Trailer Lighting


110 V. A.C.
ON-OFF SWITCH
VENTILATION HOLES
DISCONNECT 6 V. LEADS FROM BATTERY
INSERT PLUG IN ANY ONE SOCKET
0
2
4
6
8
10
12
BOX TO HOLD TRANSFORMER
TOY TRANSFORMER SET AT 6-8 V.
PARALLEL WIRING OF SOCKETS
PUT LIGHTS IN REMAINING SOCKETS
ENLARGED X-RAY VIEW OF BAYONET PLUG
TRANSFORMER

Trailers fitted with battery-operated six-volt bulbs can use the same lighting system when parked in camps where 110-volt A.C. is provided by rigging up a transformer plug-in as shown in sketches at left.

MANY house trailers are wired for lights operating on a six-volt system, utilizing the bayonet base bulbs similar to those in car headlights. These become useless in camps where 110-volt current is supplied, but on the other hand the six-volt bulbs with standard screw base are costly as well as difficult to obtain.

The lighting system illustrated in the accompanying sketches is practical and allows one set of bulbs to be used—the bayonet-base type, eliminating troublesome and dangerous extensions. Another point generally overlooked: the heat dissipated by the low-voltage bulbs is negligible—no inconsiderable factor in small trailers on hot nights!

A transformer plug-in system is utilized to drop the 110-125 volts, A.C. to 6-8 volts. The prospective user has the choice of several units, but the best, perhaps, is one of the small transformers, used to run toy trains, motors, etc. Practically all of these have a six-volt tap, and the amperage delivered to the secondary is high enough to operate several lights without overloading.

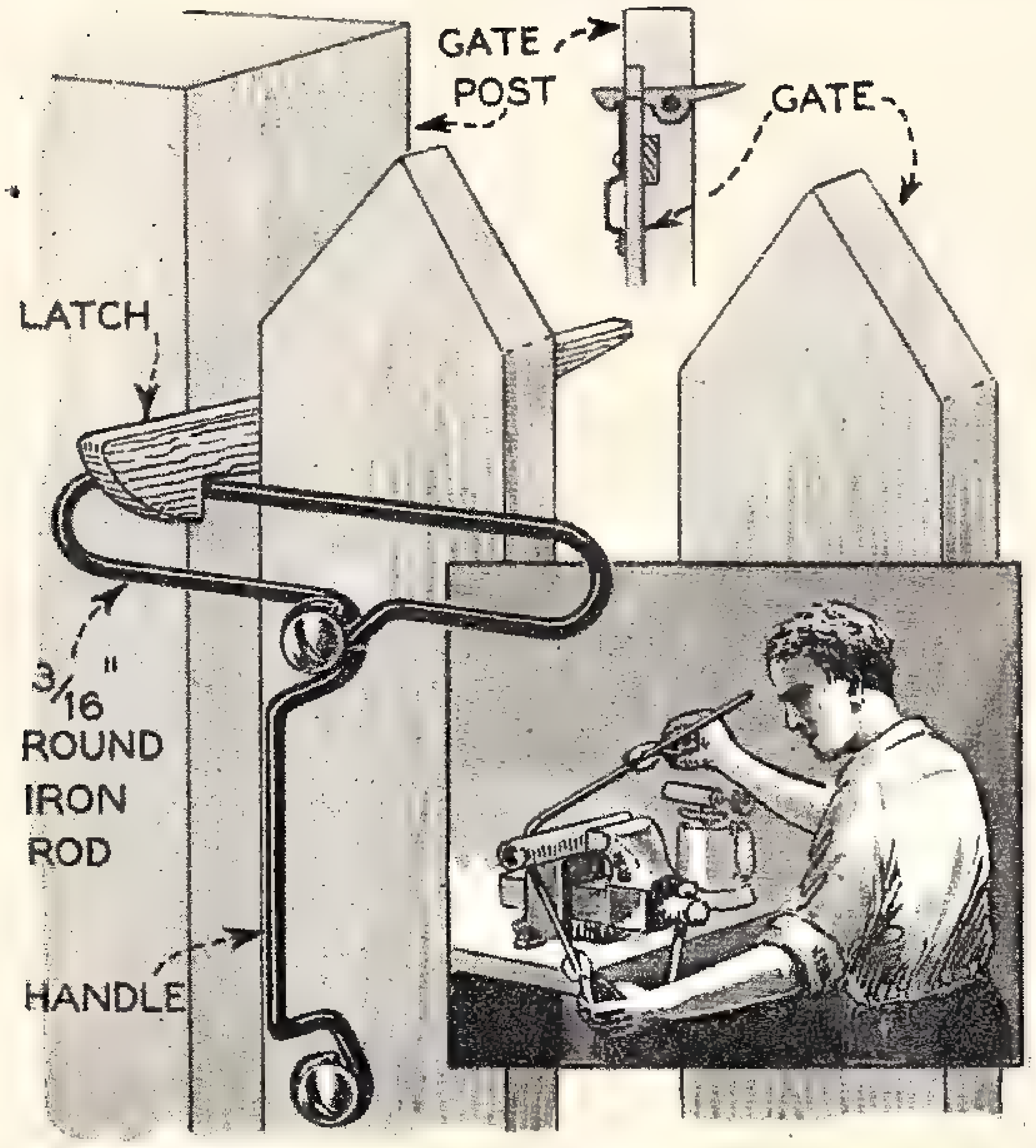
A ventilated box to house the transformer is strongly recommended. It may be constructed either of metal, pressed wood, or similar material, with leads well insulated. It can be mounted conveniently in some upper corner of the trailer—close to an available bayonet socket for the plug-in.

The illustrations show the method employed. The output of 6-8 volts is wired into a plug adapted to the type of light socket one uses. That is, the plug must be of the same type as the light base. If a double-contact bulb of one filament is used, the six-volt leads must be connected to these two contacts. If a single contact bulb is to be used, one wire of the plug goes to said contact, while the other is grounded to the metal sleeve of the socket.

The writer used the filament type of transformer designed for low-powered radio transmitters. A discarded radio receiver transformer—if it came from a set with a large number of 6.3 volt tubes—might also be used. Extreme care must be exercised not to contact the high voltage leads of this type of transformer, and it must also be insulated from accidental short circuits.

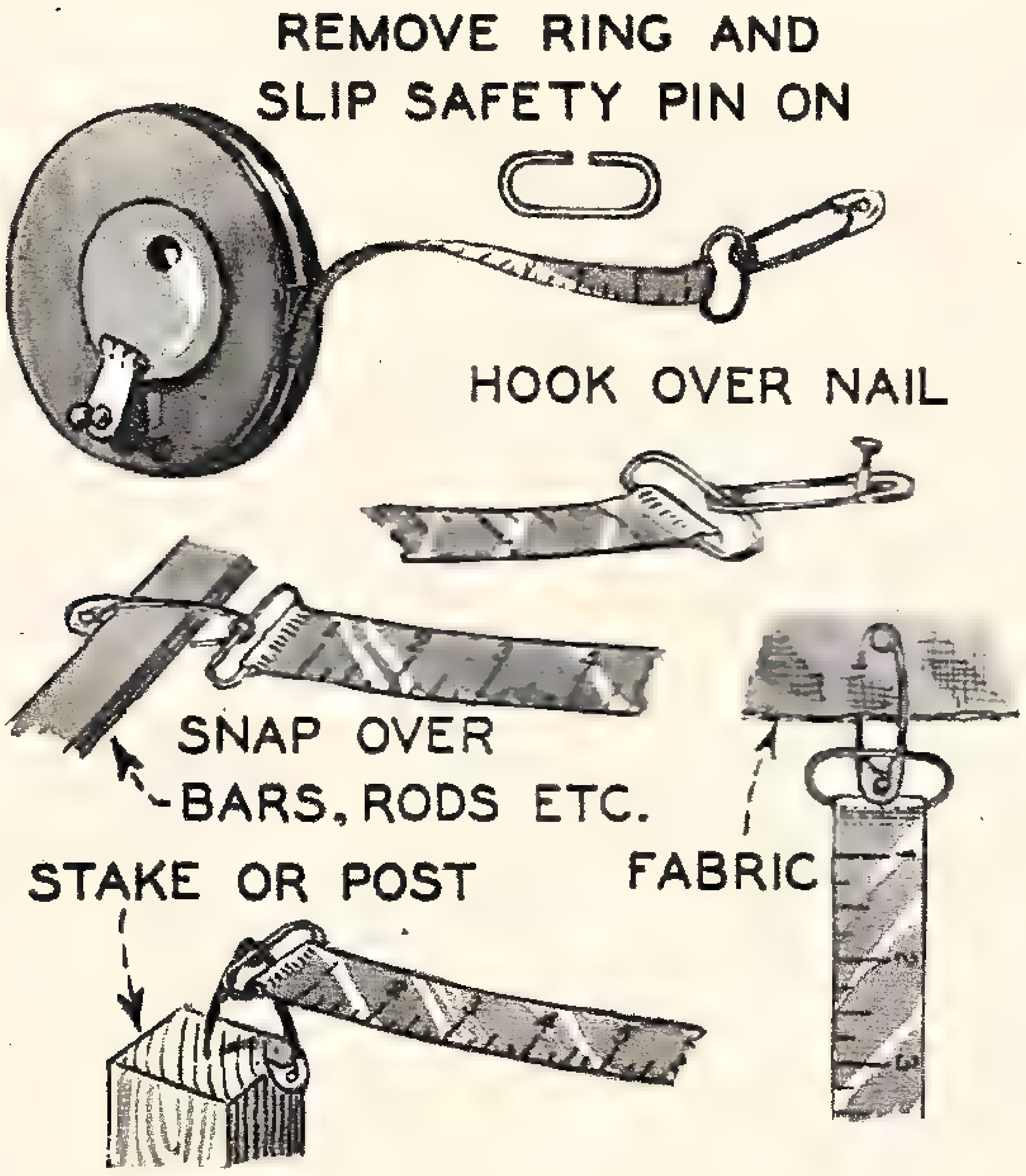
In any case when using transformers, the "On-Off" switch must be placed in the primary circuit; i. e., where it joins the high line, otherwise the transformers will remain "On" continuously.

Light Iron Bar Becomes An Efficient Gate Latch


GATE POST
GATE
LATCH
3/16" ROUND IRON ROD
HANDLE

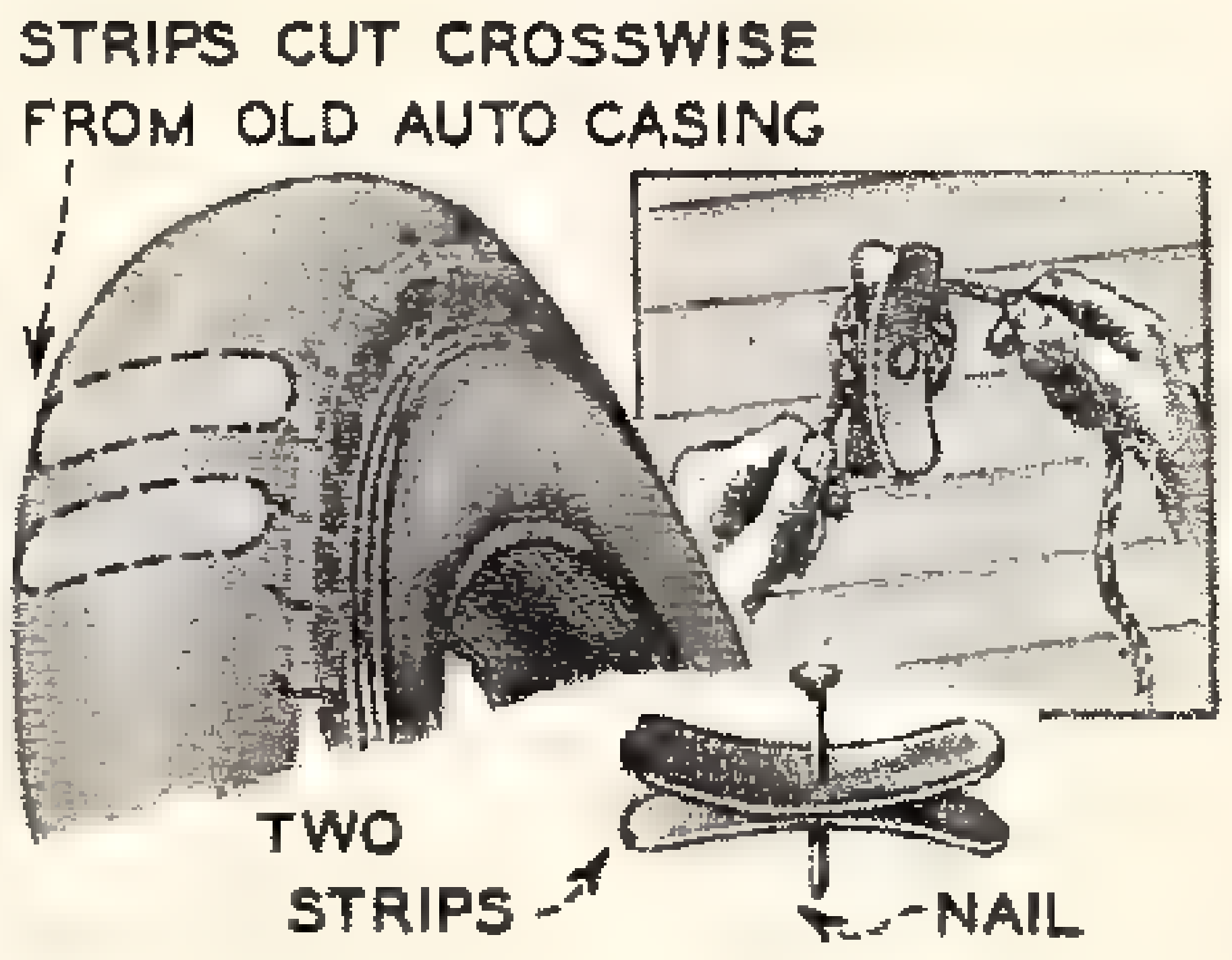
A SIMPLE and effective gate latch can be made by bending a length of $\frac{3}{16}$-inch bar iron to the form shown. Use a blow torch to heat the portion to be bent.—A. H.

Pin Improves Tape Measure


REMOVE RING AND SLIP SAFETY PIN ON
HOOK OVER NAIL
SNAP OVER BARS, RODS ETC.
STAKE OR POST
FABRIC

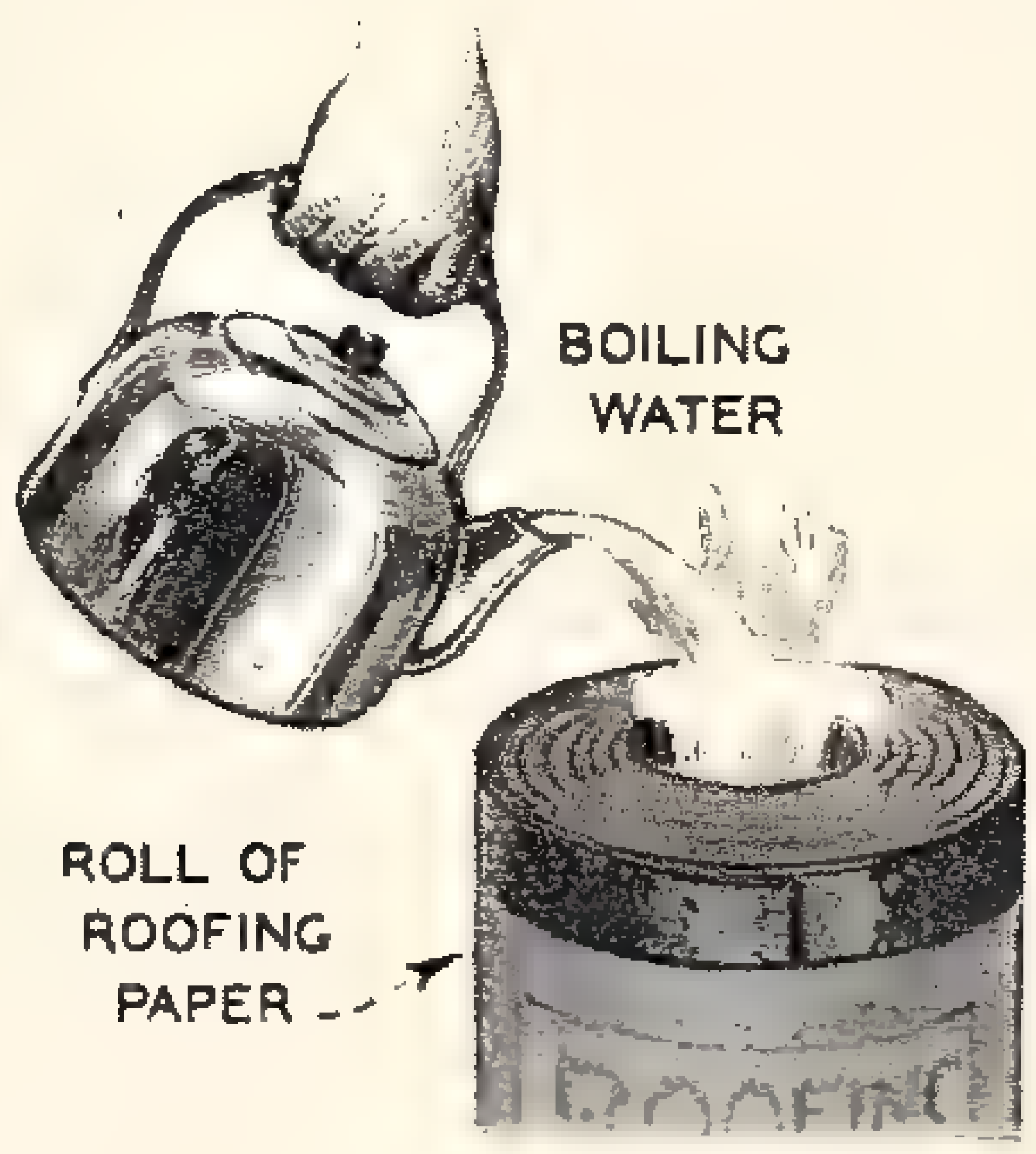
THE ordinary tape measure can be improved by fastening a safety pin to the loop at the end of the tape. When it is necessary to measure a long piece of wood, many times it is difficult to hold one end in place while the other is being moved. By driving a small pin in the end of the lumber, the safety pin can be slipped over it and will thus hold the tape in place.—A. Tempe.

Cleats Made From Old Tire


STRIPS CUT CROSSWISE FROM OLD AUTO CASING
TWO STRIPS
NAIL

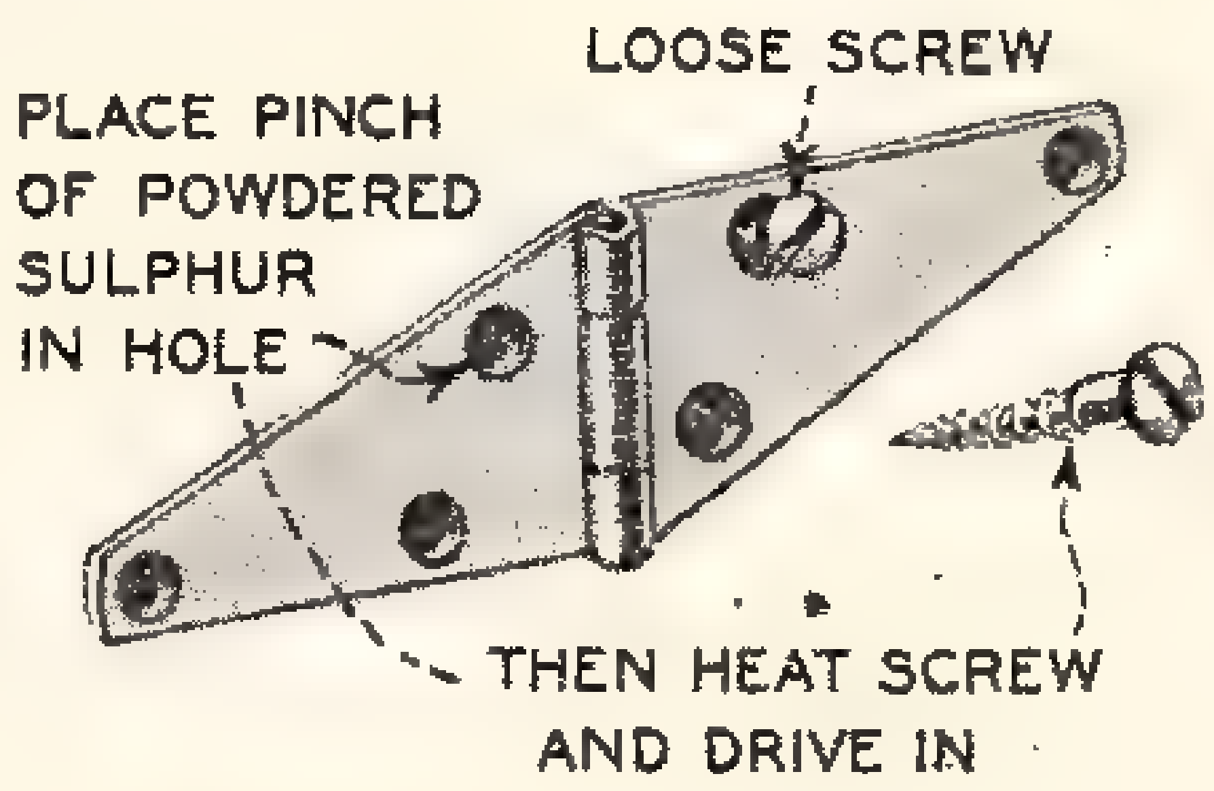
FOR fastening small ropes or cords from porch flaps, awnings, roll shades, Venetian blinds, etc., the tieless cleats shown in the drawing will be found most convenient. Two strips cut from an old tire and fastened as shown will hold light rope or cord just as securely as the more conventional wood or metal cleats.—A. H.

Water Stops Roofing Tears


BOILING WATER
ROLL OF ROOFING PAPER
ROOFING

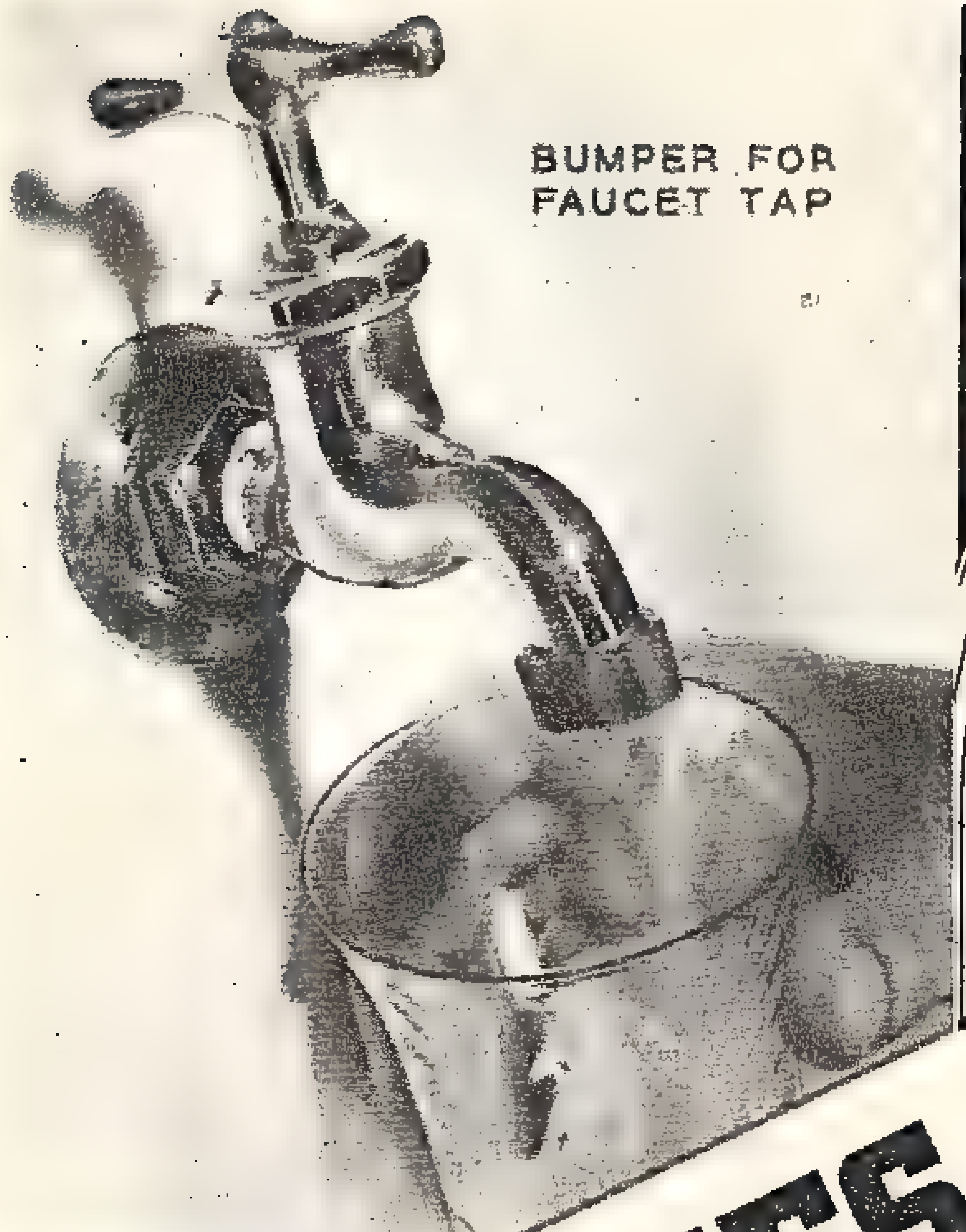
TAR paper roofing many times will tear as it is unrolled because of the ends sticking together. This condition can be eliminated by pouring boiling water on each end of the roll before it is unrolled.—A. T.

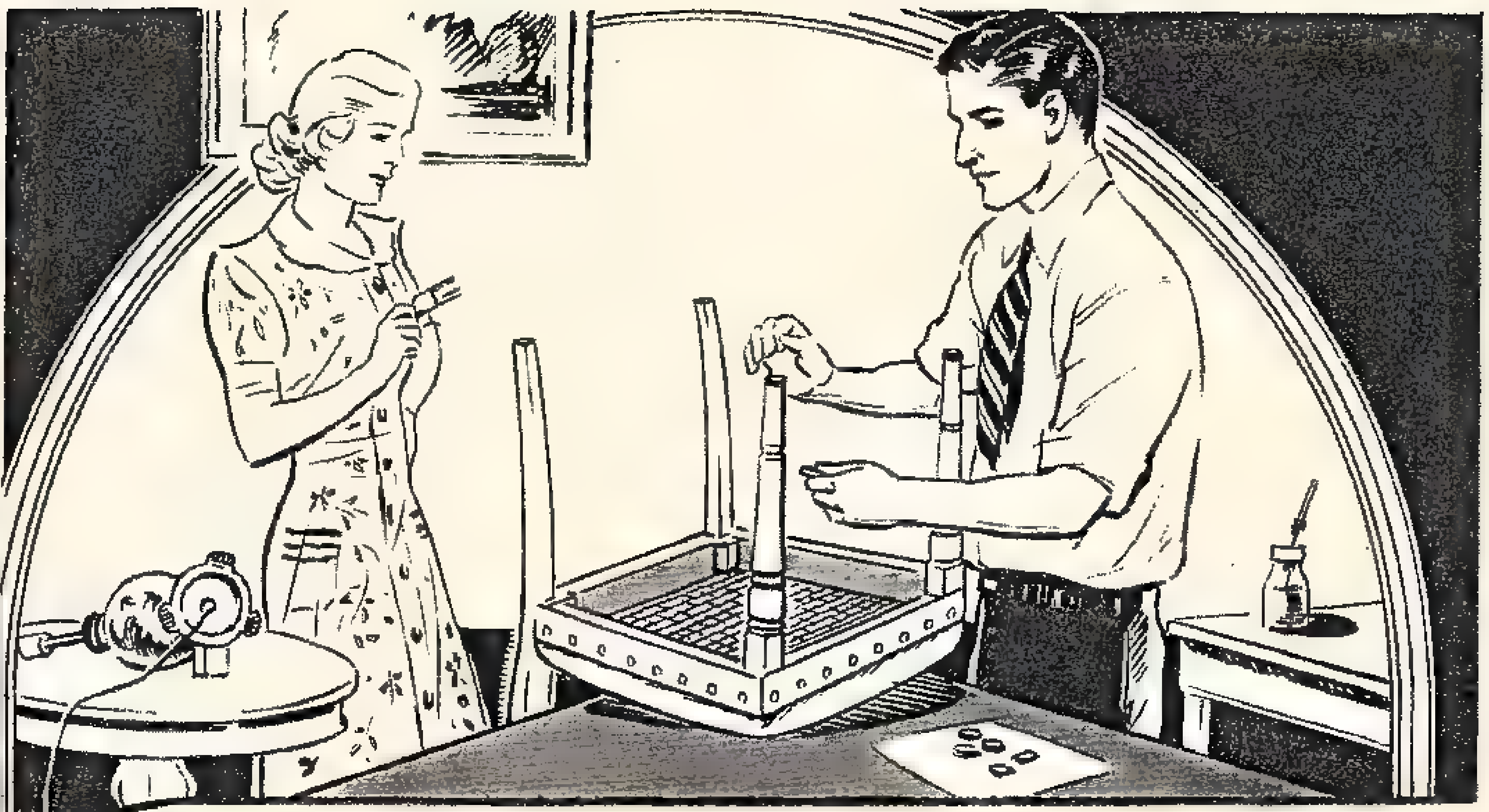
Sulphur Holds Loose Screws


LOOSE SCREW
PLACE PINCH OF POWDERED SULPHUR IN HOLE
THEN HEAT SCREW AND DRIVE IN

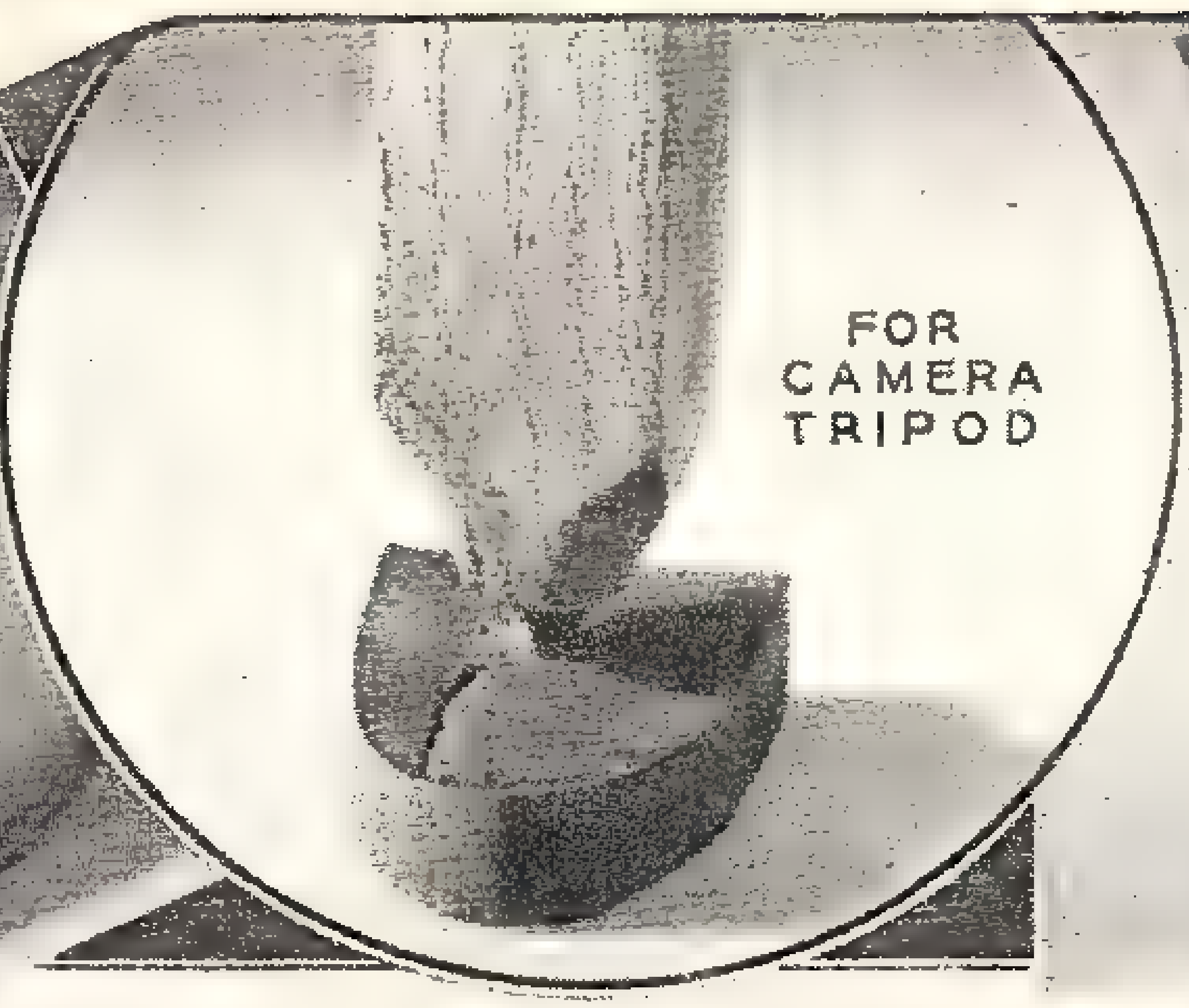
THE screws holding hinges often become loose after a few months of use. This annoying condition can be eliminated by placing a small quantity of sulphur in the hole before the screw is in place. The screws should be heated until it will melt the sulphur, and then screwed into place. When it has cooled, the sulphur will harden and hold screw securely in place.—Waychoff.

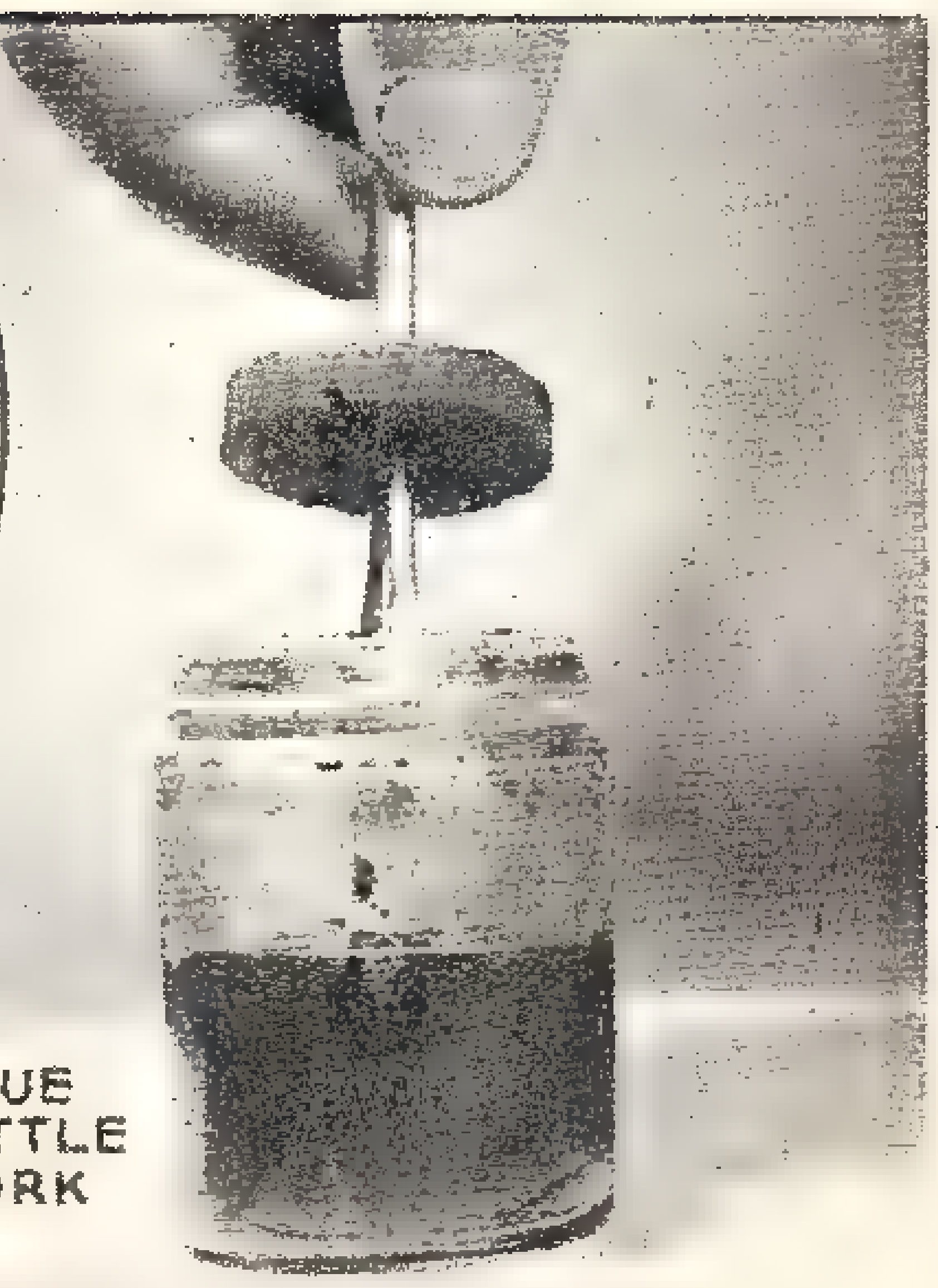
NEW USES for Rubber Heels





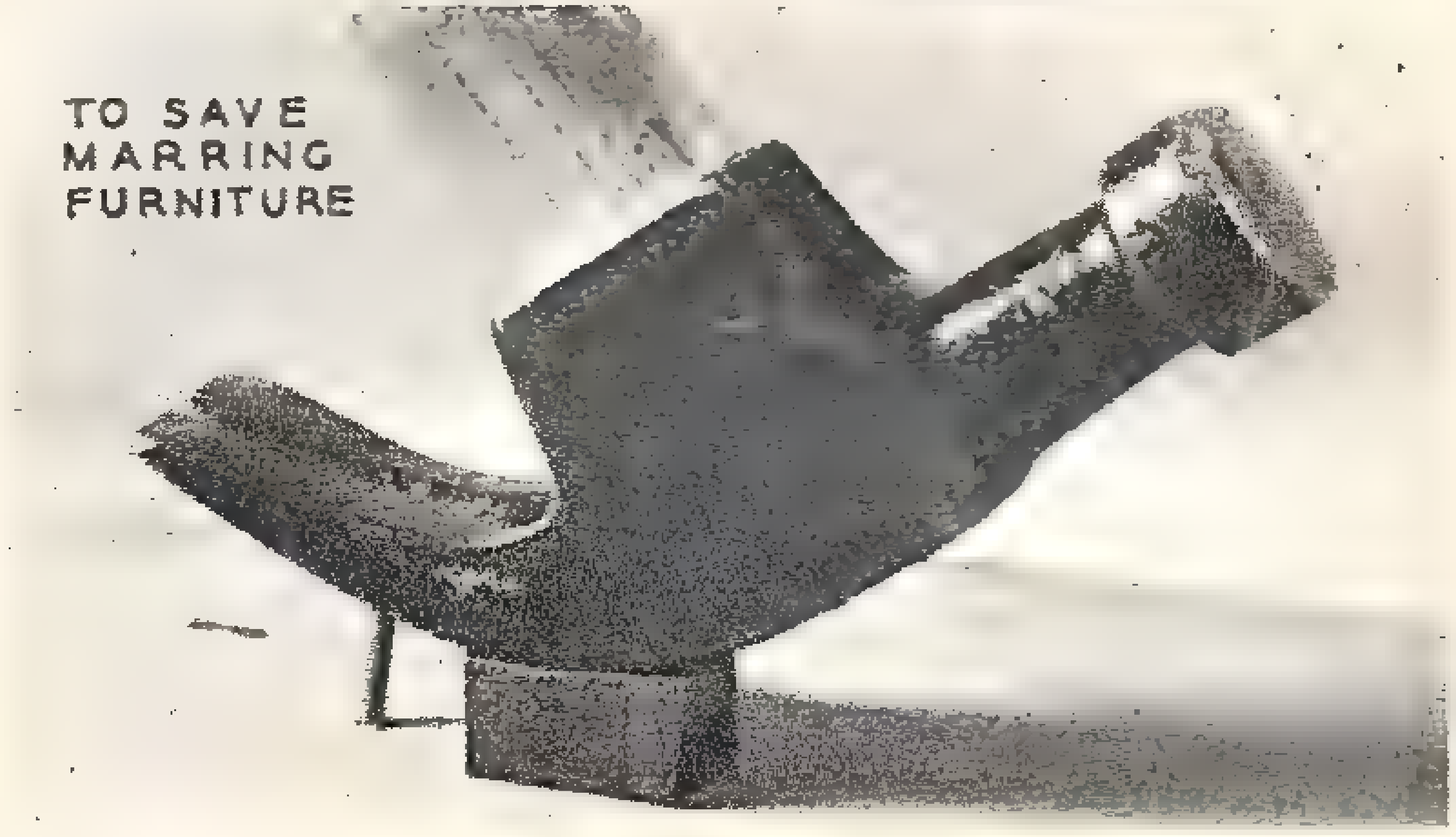
REMOVE EMBOSSMENTS



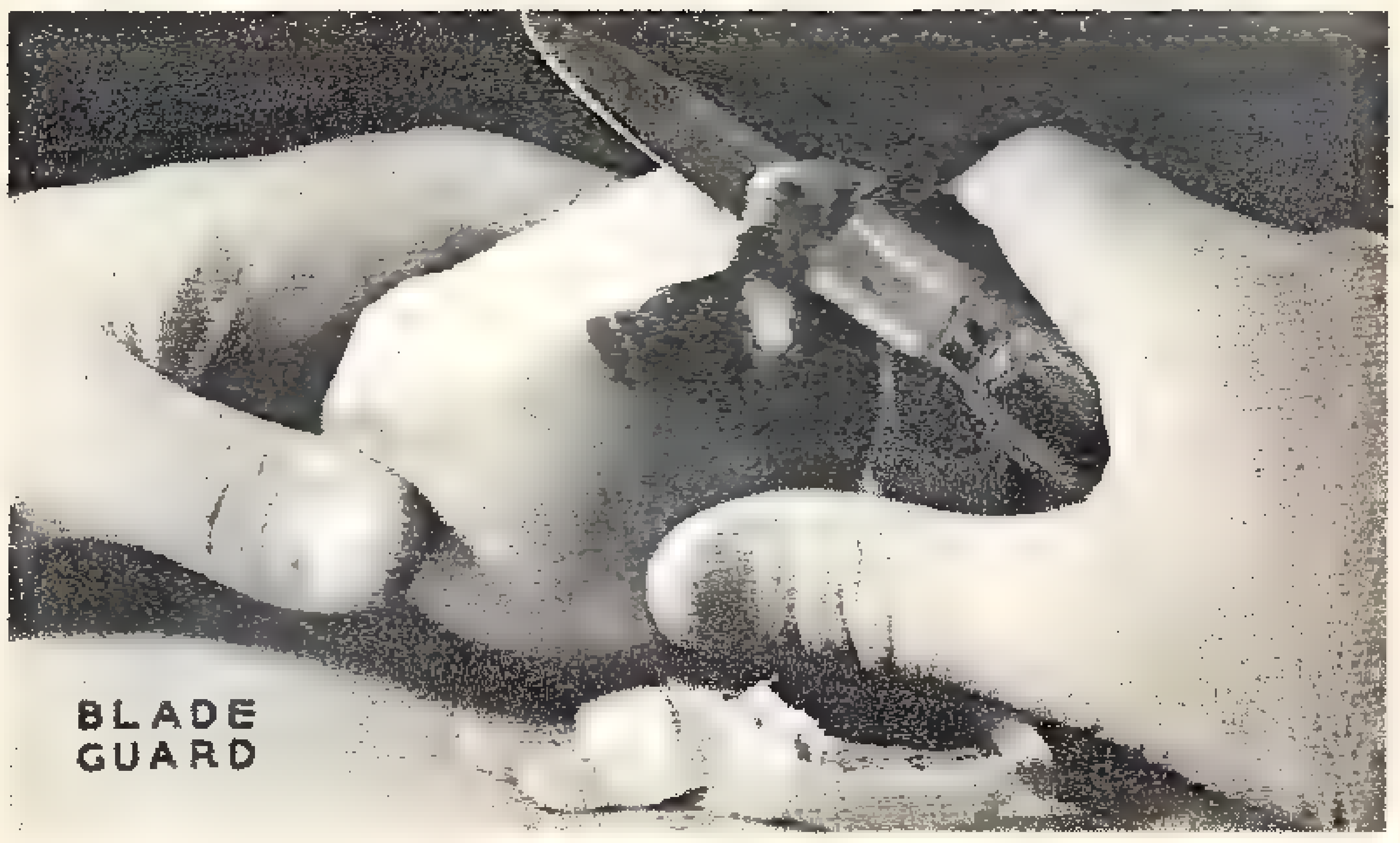


Faucet tap "bumpers," camera tripod "anti-skids" and glue pot corks are but a few of the many novel uses for old rubber heels usually thrown away.

Use a sharp knife to cut the rubber heels. When making faucet washers, trim off the embossing as shown above. A power jig saw will speed the cutting operation and produce neater work when cutting the heels to intricate shapes, although its use is not essential if careful work is done.



A block of rubber inserted under a claw hammer makes it impossible to mar the surface of woodwork when pulling nails. Block may be permanently attached to hammer with countersunk machine bolt. Below—An effective paring-knife guard.



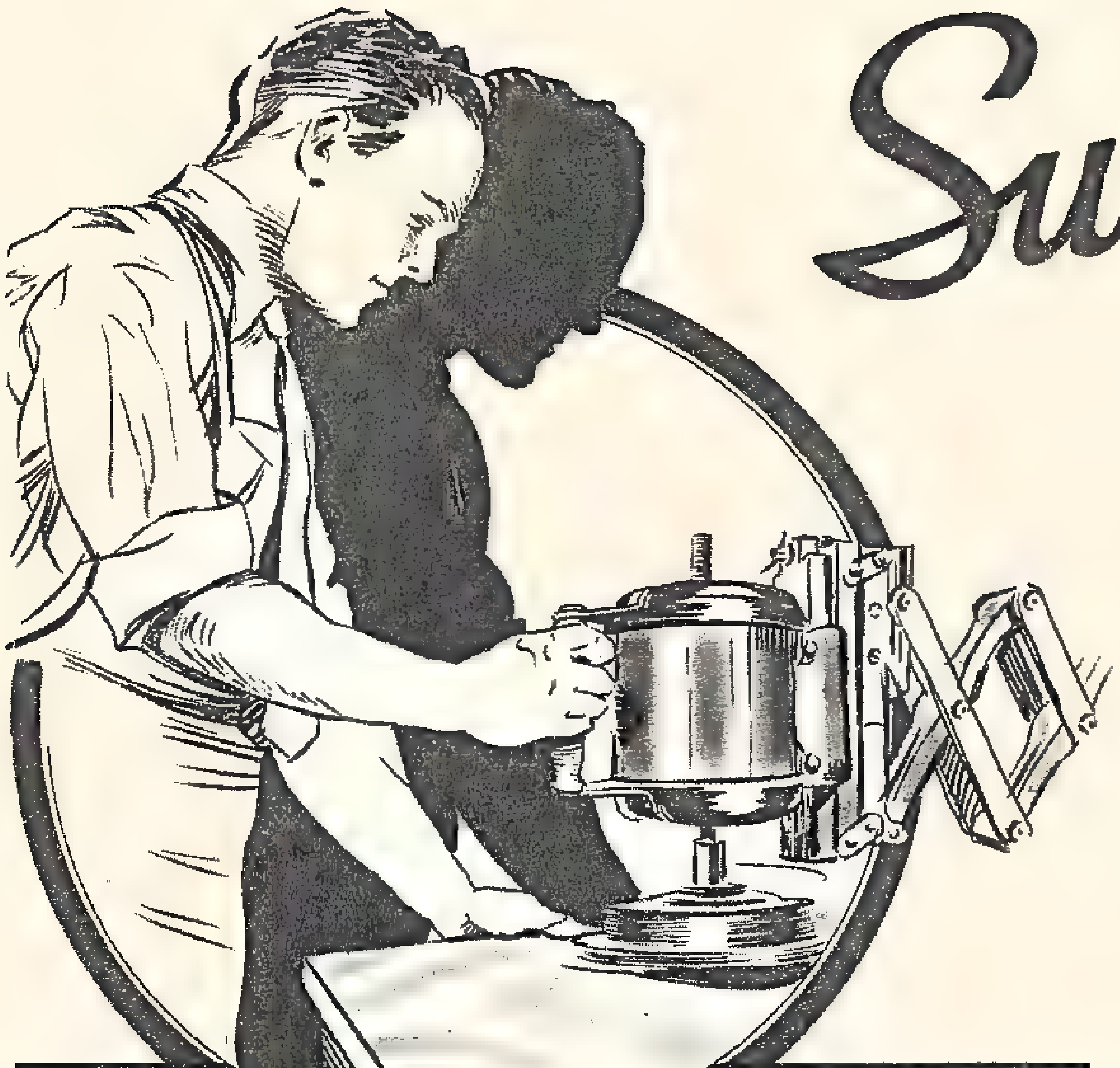
THE next time the door of your car rattles, hunt up an old pair of shoes and cut off a piece of rubber heel. Long-wearing and tough, it has just enough "spring" to silence noises of this kind. A larger piece, cut into the shape of a wedge, makes an excellent and practical door stop in the home or workshop.

Unusual ways in which rubber heels can be utilized are shown in the illustrations. Purchased new at the department store, they cost only 10 cents a pair. Be sure to select the largest size available. The material, while not composed of pure rubber, is often a good and inexpensive substitute for small blocks of fibre in radio and many other types of construction work. It cuts easily with a sharp knife, especially if wet, and more accurate cutting can be done with a hand or power scroll saw. In order to cement it to

[*Continued on page* 128]

Swinging ARM

by Dick Cole



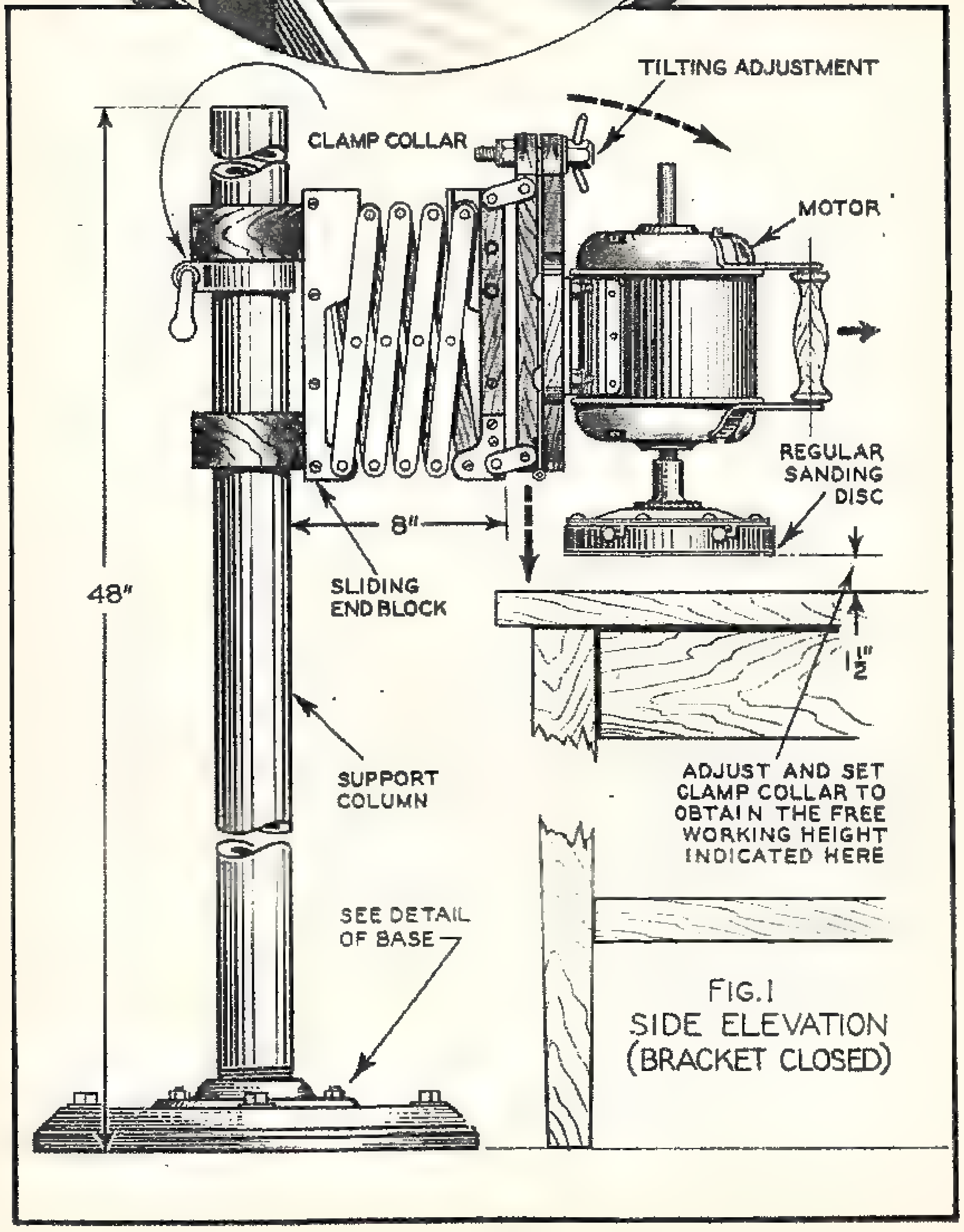


FIG. 1
SIDE ELEVATION
(BRACKET CLOSED)

HERE is a home-made, motor-driven tool which will appeal to every cabinet maker and home-workshop enthusiast. It solves the problem of machine-sanding large surfaces. It is powered with a ¼ h. p. or ⅓ h. p. motor and will turn out excellent sanding jobs on big table-tops, dresser-tops, large panels, wide boards, etc. It eliminates the laborious task of hand sanding, which is probably the most unpleasant part of woodworking.

The construction and operation of the sander are visualized in Figs. 1, 2 and 3. It will be seen that the sanding disk is mounted directly to the end of the motor shaft. The motor itself is mounted vertically at the end of a parallelogram type extension bracket, which, in turn, is free to swing on the tubular supporting column. Thus the sanding disk is always parallel to the surface to be sanded and can be moved over a wide area.

An objection to a disk-type sander—that it leaves circular scratches on the job—is overcome by using a bevel-face disk to finish off the work. The disk is moved with the grain of the wood and produces a first-class job.

The swinging arm sander is intended to be mounted directly to a drill-press column. When not in use, it can be swung to the side, and will not impede any of the usual drill-press operations.

If one does not have a suitable drill-press, then a column must be made as shown in the drawings. This consists of a 48" length of 2¾" iron pipe, dressed down to 2½" outside diameter, and tightly screwed into a 2½" floor flange. This is mounted on a 16" wooden disk, which, in turn, is secured to the floor with lag-screws. The base is actually built up of two ¾"x16" disks glued together with grain opposed. Hardwood is recommended for the base, but ordinary pine will serve.

We now come to the construction of the extension bracket itself. If the prospective builder will check each individual part against the plans and the photographs, he will glean a complete understanding of the construction of the assembly. Now let us start building the bracket from the column end outward. First we have the sliding end-block. It will be seen that this is built up of select maple into a composite unit (Fig. 3). It is well to

Easily constructed tool solves problem of sanding large areas with little effort.

SANDER *you can make*

bore the holes on a lathe for accuracy. If desired, these holes can be bushed with a brass ring, but the bushings will serve very little purpose. The maple alone is amply strong and, when polished and greased, makes an excellent bearing surface.

In any parallelogram type extension bracket one end of the arms at each end of the bracket must be free to have vertical movement. On this bracket the end arms are attached to a cross-shaft with rollers which travel in a channel made of $\frac{3}{32}$"x1¾"x1¾" angle iron. The formation of these channels is clearly shown in the detail of the sliding end-block. The elevation of the bracket on the column is set with the simple clamp collar shown in Fig. 3.

The middle arms of the bracket are of select maple. Fig. 3 shows the special arm used at the column end of the bracket. It will be seen that a $\frac{5}{16}$" rod, with a roller on each end, passes through the arm. The rod

Right—Drawing of the sander completely assembled. Note that when the bevel-faced disc is used, the mounting is tilted to correct angle for flat contact with work. Below — The completed sander mounted on a drill press column.

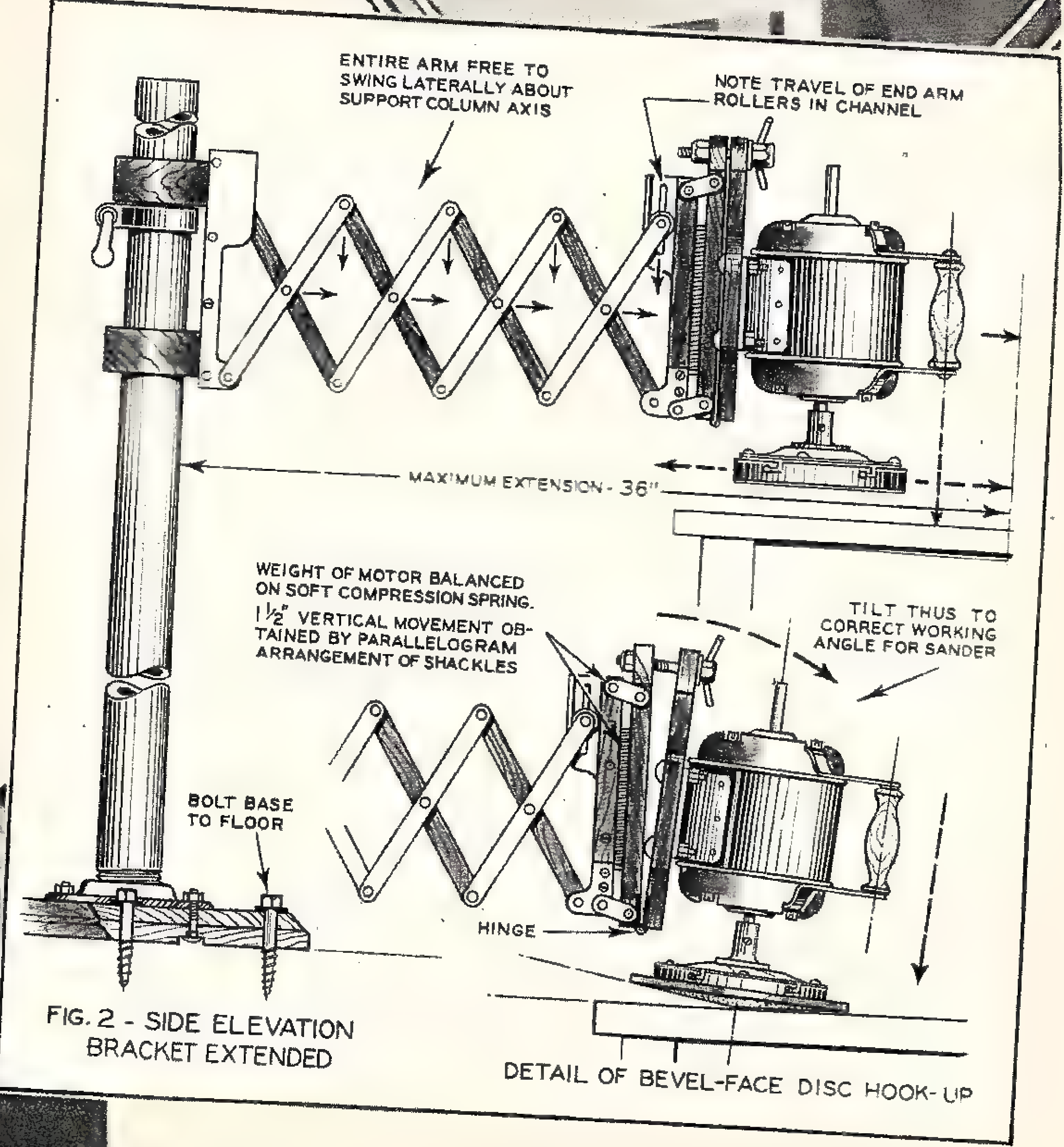
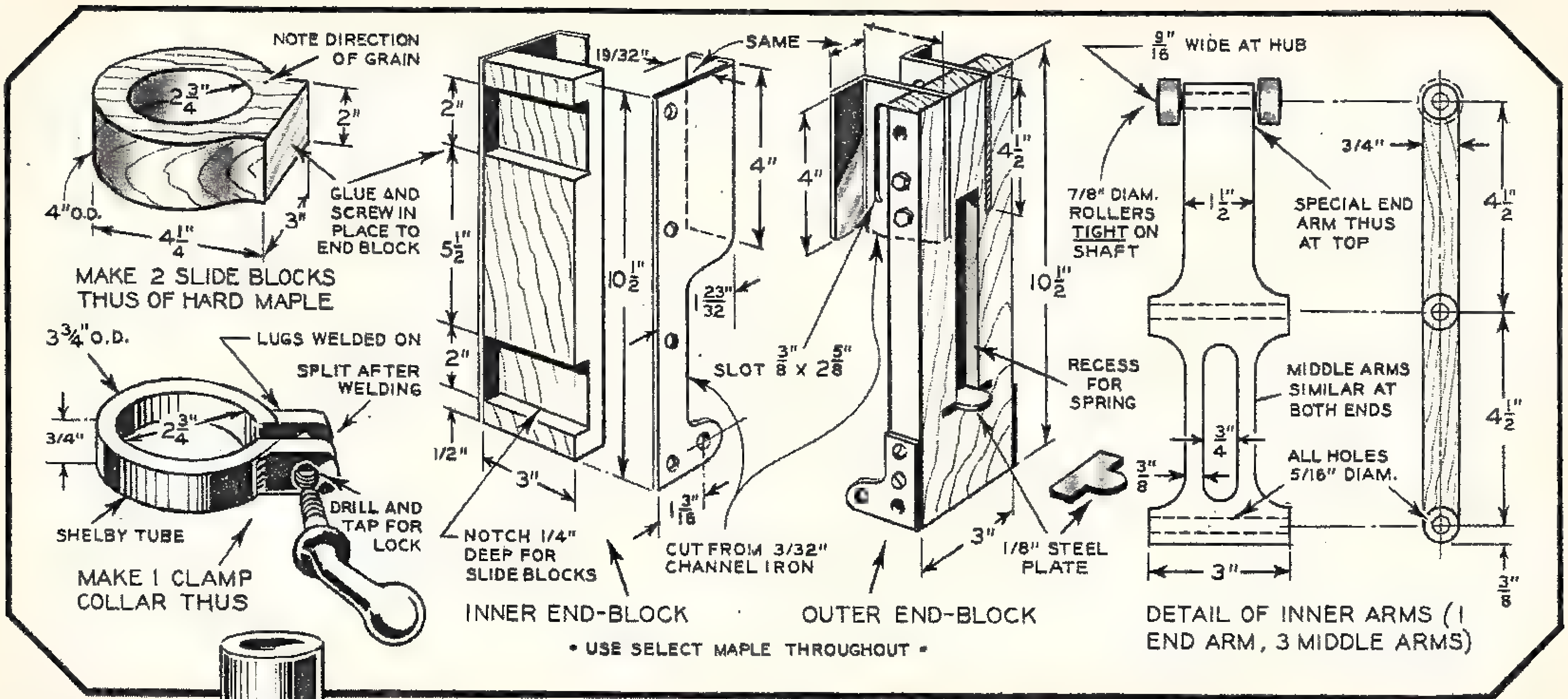
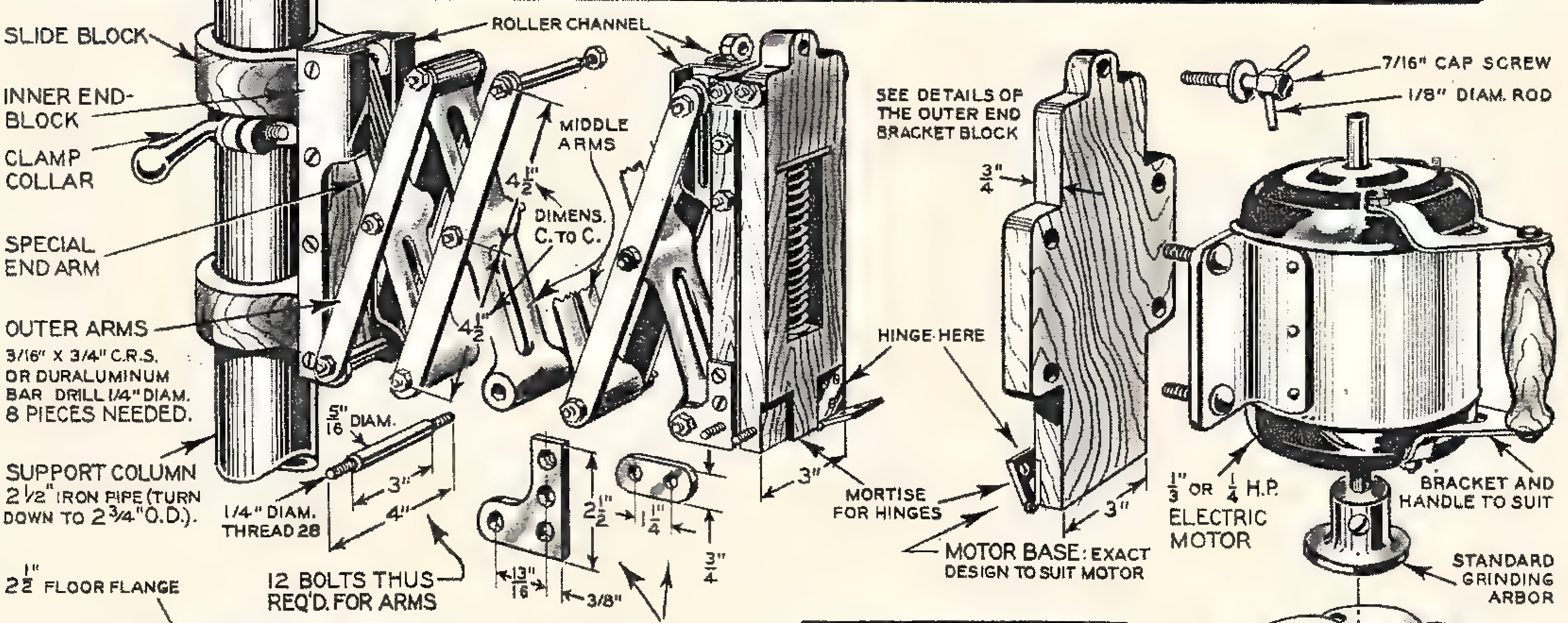

ENTIRE ARM FREE TO SWING LATERALLY ABOUT SUPPORT COLUMN AXIS
NOTE TRAVEL OF END ARM ROLLERS IN CHANNEL
MAXIMUM EXTENSION - 36"
WEIGHT OF MOTOR BALANCED ON SOFT COMPRESSION SPRING.
1½" VERTICAL MOVEMENT OBTAINED BY PARALLELOGRAM ARRANGEMENT OF SHACKLES
TILT THUS TO CORRECT WORKING ANGLE FOR SANDER
BOLT BASE TO FLOOR
HINGE

FIG. 2 - SIDE ELEVATION BRACKET EXTENDED

DETAIL OF BEVEL-FACE DISC HOOK-UP


NOTE DIRECTION OF GRAIN
2 3/4"
2"
4" O.D.
4 1/4"
3"
GLUE AND SCREW IN PLACE TO END BLOCK
MAKE 2 SLIDE BLOCKS THUS OF HARD MAPLE
3 3/4" O.D.
LUGS WELDED ON
SPLIT AFTER WELDING
3/4"
2 3/4"
DRILL AND TAP FOR LOCK
SHELBY TUBE
MAKE 1 CLAMP COLLAR THUS
19/32"
SAME
2"
4"
5 1/2"
10 1/2"
1 23/32"
2"
SLOT 3/8" x 2 5/8"
1/2"
3"
1 3/16"
NOTCH 1/4" DEEP FOR SLIDE BLOCKS
CUT FROM 3/32" CHANNEL IRON
INNER END-BLOCK
4"
4 1/2"
10 1/2"
RECESS FOR SPRING
3"
1/8" STEEL PLATE
OUTER END-BLOCK
• USE SELECT MAPLE THROUGHOUT •
9/16" WIDE AT HUB
7/8" DIAM. ROLLERS TIGHT ON SHAFT
1 1/2"
SPECIAL END ARM THUS AT TOP
3/4"
4 1/2"
MIDDLE ARMS SIMILAR AT BOTH ENDS
4 1/2"
3/4"
3/8"
ALL HOLES 5/16" DIAM.
3"
3/8"
DETAIL OF INNER ARMS (1 END ARM, 3 MIDDLE ARMS)


SLIDE BLOCK
INNER END-BLOCK
CLAMP COLLAR
SPECIAL END ARM
OUTER ARMS 3/16" X 3/4" C.R.S. OR DURALUMINUM BAR DRILL 1/4" DIAM. 8 PIECES NEEDED.
SUPPORT COLUMN 2 1/2" IRON PIPE (TURN DOWN TO 2 3/4" O.D.).
ROLLER CHANNEL
MIDDLE ARMS
4 1/2"
DIMENS. C. TO C.
4 1/2"
5/16" DIAM.
3"
4"
1/4" DIAM. THREAD 28
12 BOLTS THUS REQ'D. FOR ARMS
2 1/2"
1 1/4"
13/16"
3/8"
3/4"
3"
SEE DETAILS OF THE OUTER END BRACKET BLOCK
3/4"
HINGE HERE
MORTISE FOR HINGES
3"
MOTOR BASE: EXACT DESIGN TO SUIT MOTOR
7/16" CAP SCREW
1/8" DIAM. ROD
1/3" OR 1/4 H.P. ELECTRIC MOTOR
BRACKET AND HANDLE TO SUIT
STANDARD GRINDING ARBOR

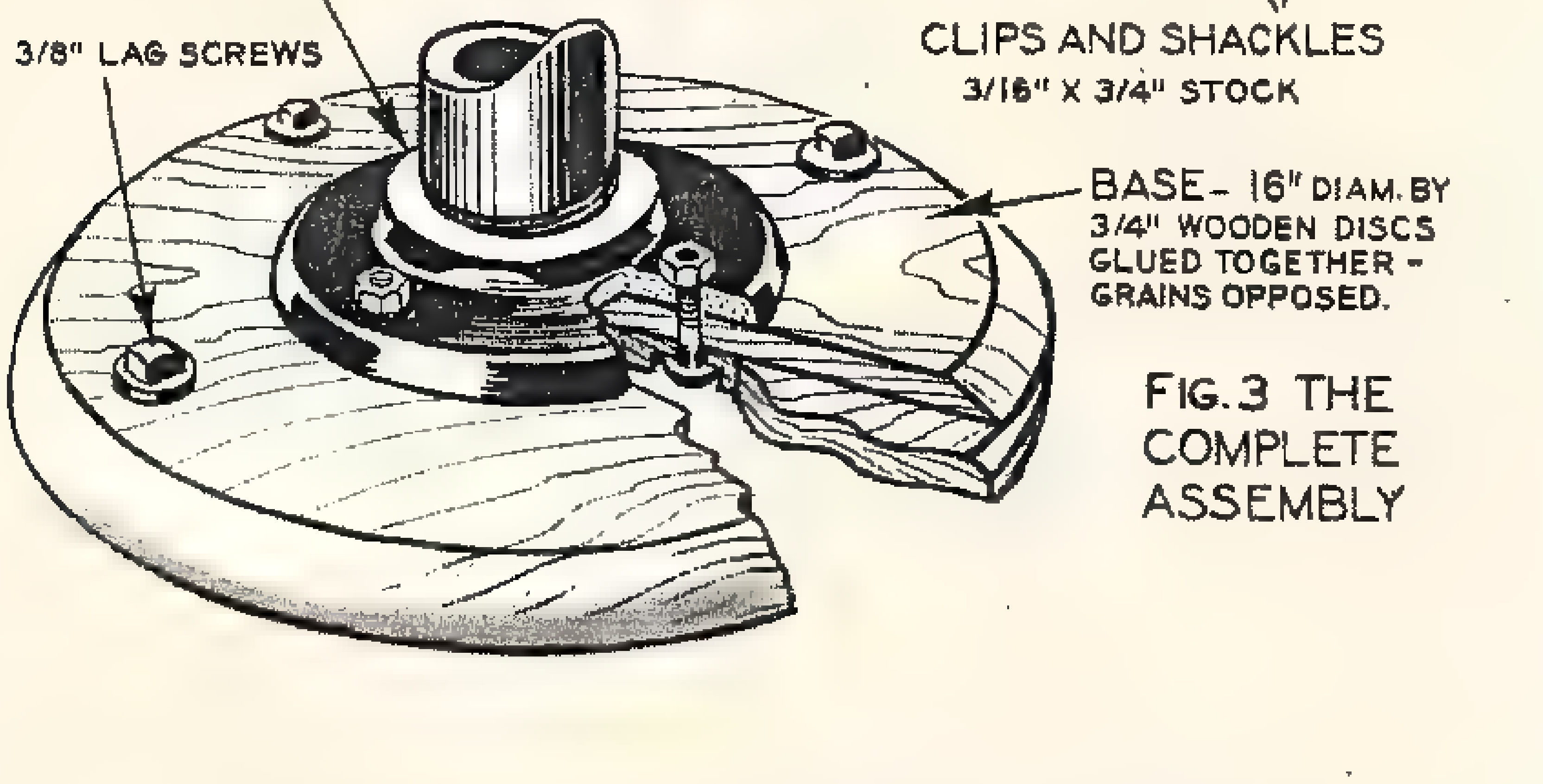
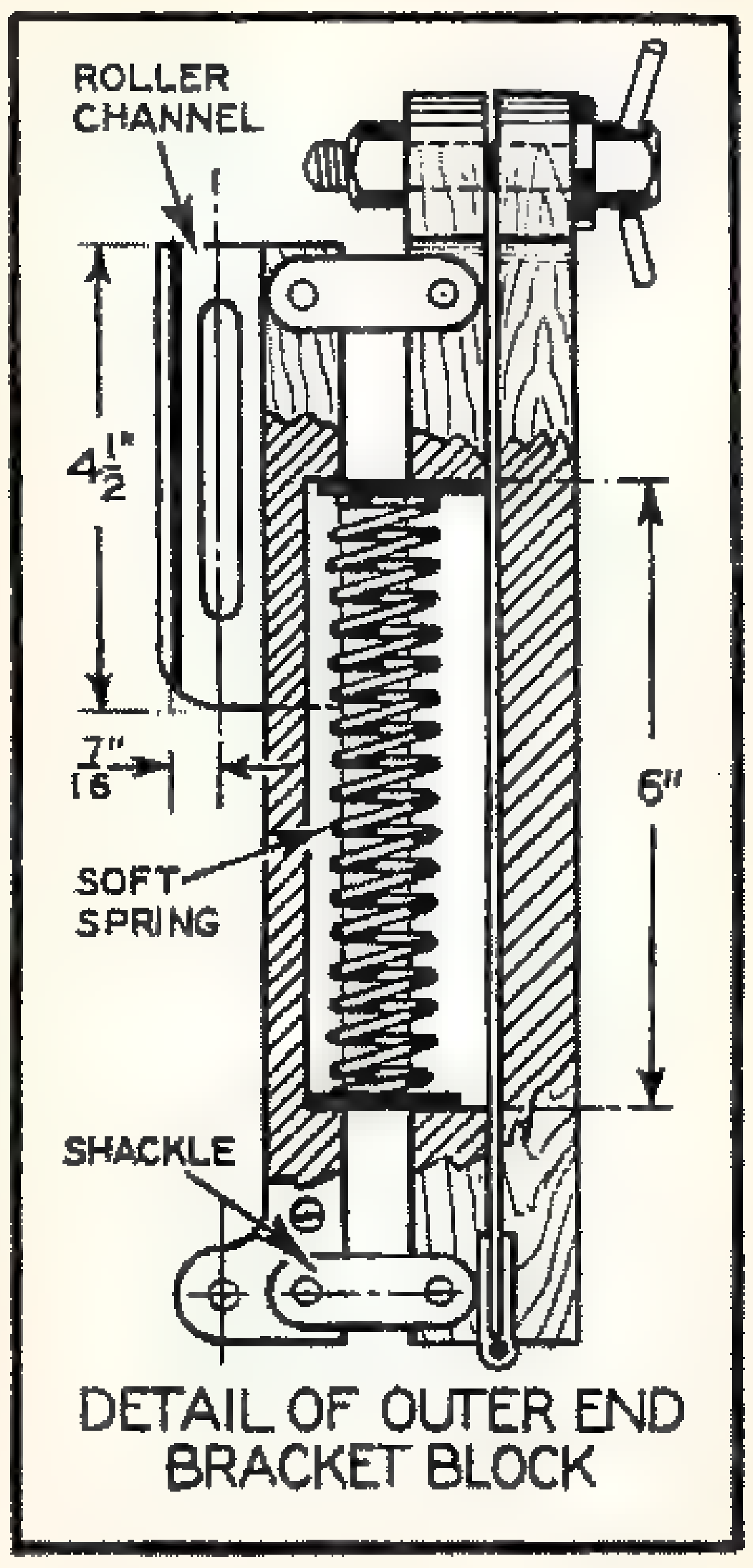
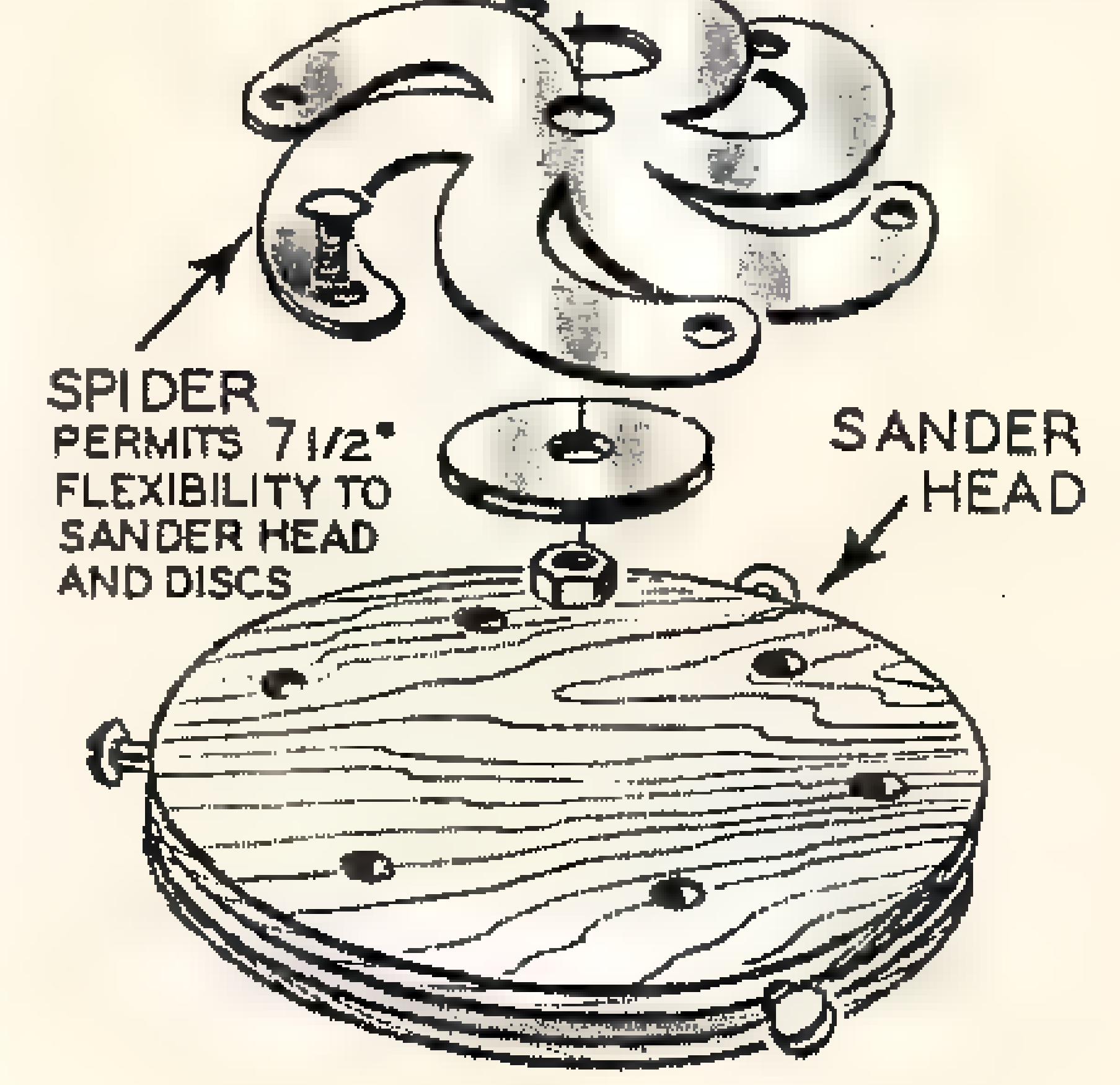

CLIPS AND SHACKLES 3/16" X 3/4" STOCK
2 1/2" FLOOR FLANGE
3/8" LAG SCREWS
BASE- 16" DIAM. BY 3/4" WOODEN DISCS GLUED TOGETHER - GRAINS OPPOSED.

FIG. 3 THE COMPLETE ASSEMBLY


ROLLER CHANNEL
4 1/2"
7/16"
6"
SOFT SPRING
SHACKLE

DETAIL OF OUTER END BRACKET BLOCK


SPIDER PERMITS 7 1/2° FLEXIBILITY TO SANDER HEAD AND DISCS
SANDER HEAD

Above is shown the construction details of the arm supporting the motor and disc sander. By careful study of each part before work is started, the final assembly job will be simplified.

is a press fit in the wood, and the rollers turn on the rod. This is mentioned because at all other points in the bracket construction, the cross-rods turn freely in the wood. Similar rollers are used at the outer end of bracket, so four rollers are required, all of them ⅞″ diameter and not more than $\frac{9}{16}$″ wide.

The other three middle arms differ but slightly. The pattern can readily be cut out on a scroll saw. Care must be taken in boring the holes. If these are inaccurately spaced, or not exactly parallel, it will cause binding in the operation of the bracket. A reasonably accurate jig can be made of hard maple, which will serve in boring the metal arms as well as the maple arms.

Eight outer arms are required. If $\frac{3}{16}$″x¾″ dural bar is readily available, its use is recommended. Otherwise use cold rolled steel. It is well to refer at this point to the outer end roller shaft.

Fig. 3 presents the plan cross-section of the bracket block, outer end. Again

3/32"x1¾"x1¾" angle iron serves as a channel for the rollers. The outer block is really a composite of three blocks held together with shackles and hinges, so that the motor has a limited vertical and tilting movement. By checking each individual part against the complete assembly, the construction will be obvious.

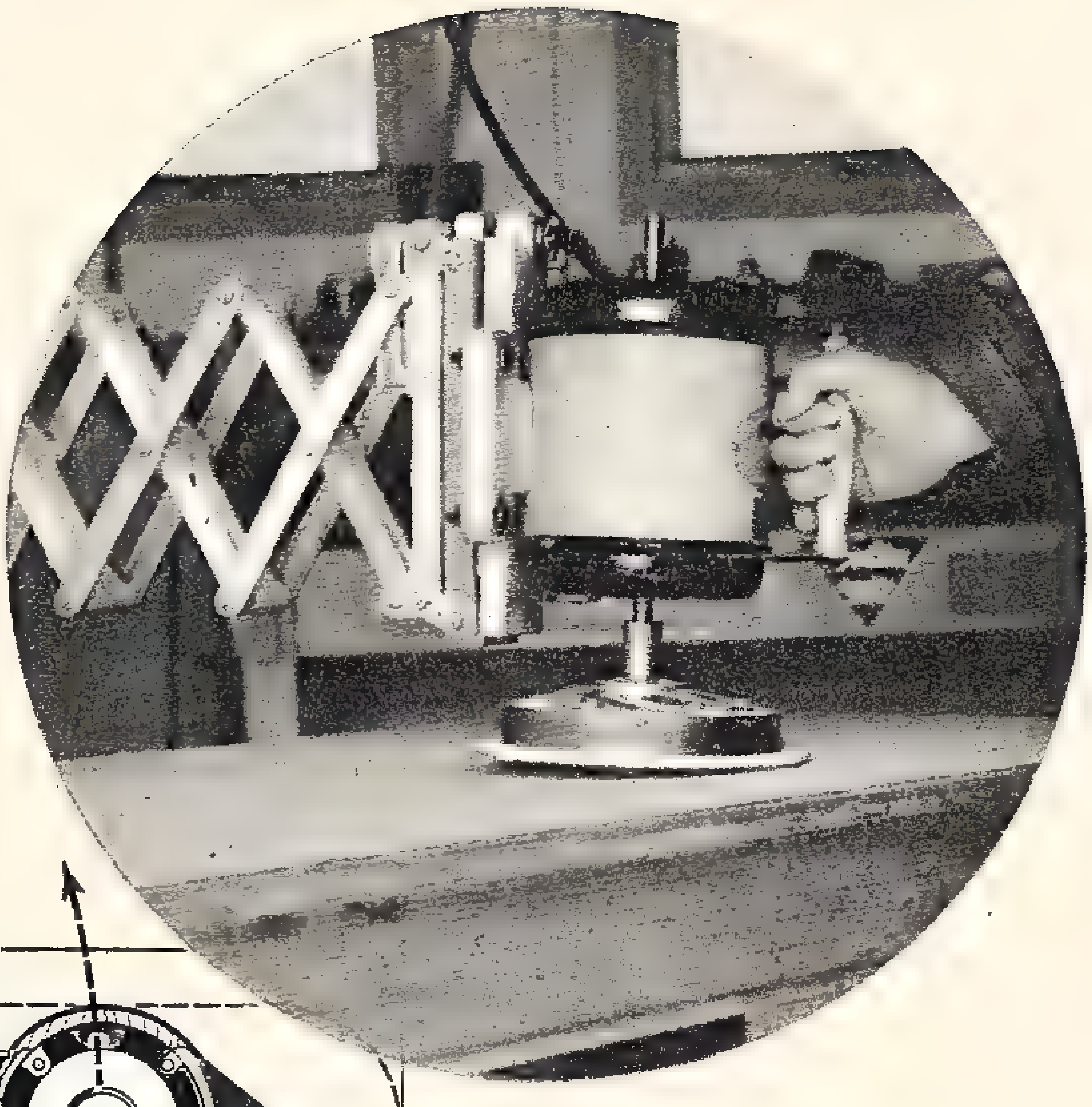
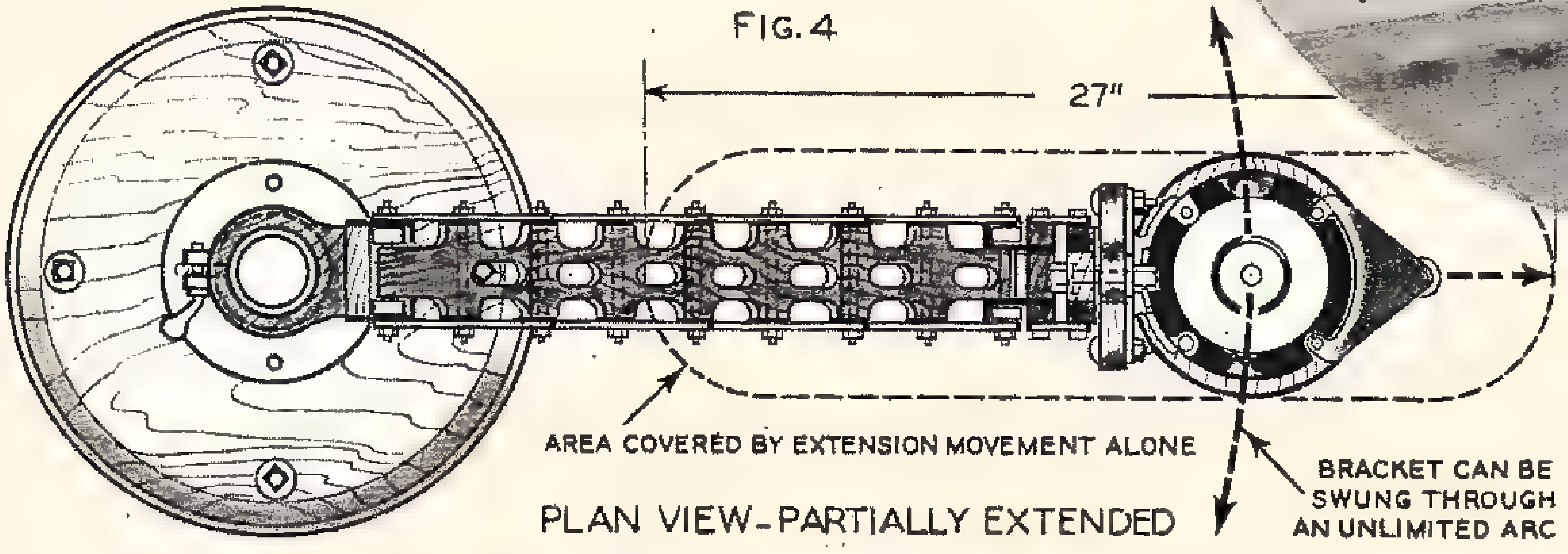


FIG. 4


27"
AREA COVERED BY EXTENSION MOVEMENT ALONE
BRACKET CAN BE SWUNG THROUGH AN UNLIMITED ARC

PLAN VIEW-PARTIALLY EXTENDED

Above is shown the sander in operation. At left is a plan view of the arm partially extended. Below are construction details of the sander disc.

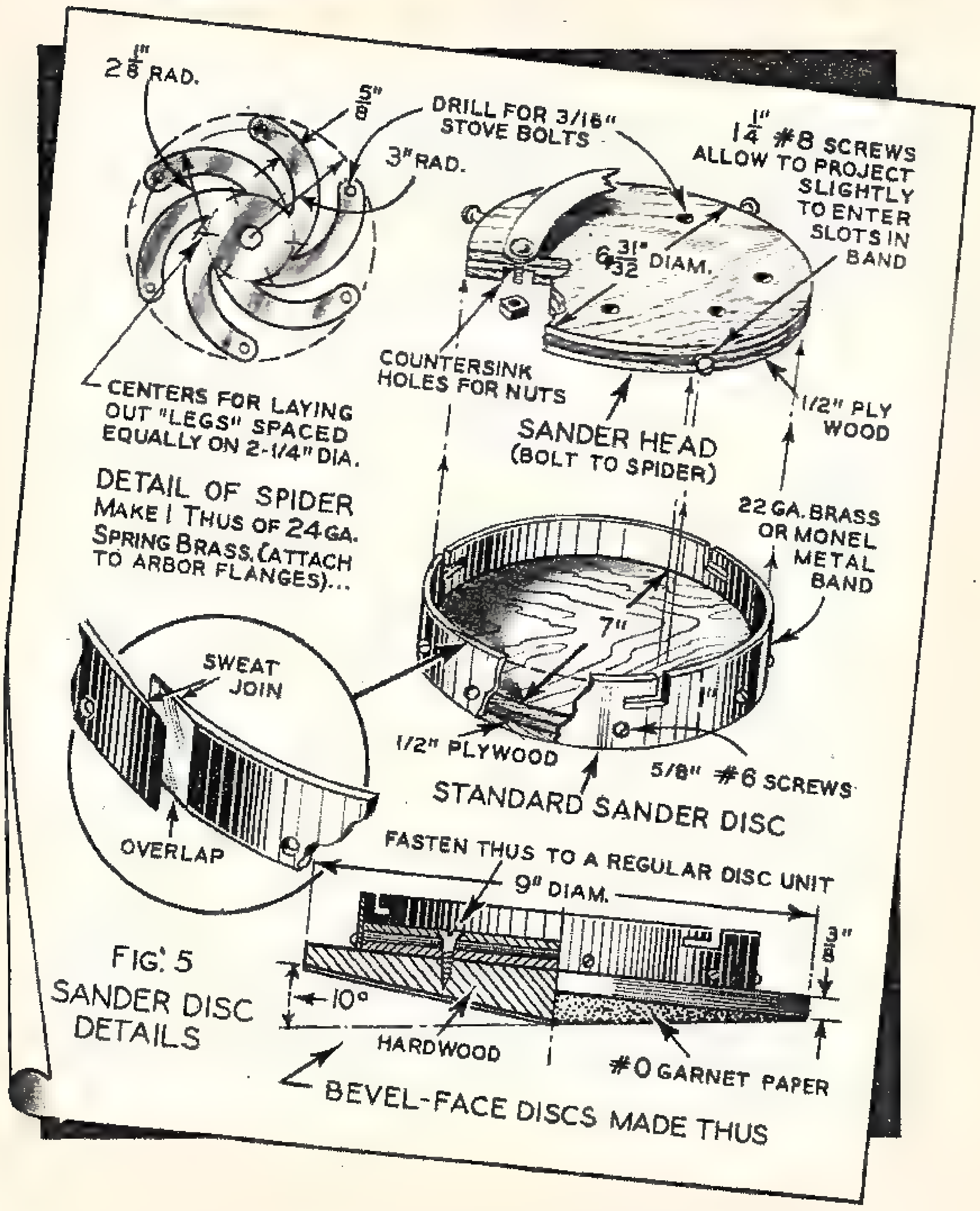

2⅛" RAD.
5/8"
DRILL FOR 3/16" STOVE BOLTS
1¼" #8 SCREWS ALLOW TO PROJECT SLIGHTLY TO ENTER SLOTS IN BAND
3" RAD.
6 31/32" DIAM.
COUNTERSINK HOLES FOR NUTS
1/2" PLY WOOD
CENTERS FOR LAYING OUT "LEGS" SPACED EQUALLY ON 2-1/4" DIA.
SANDER HEAD (BOLT TO SPIDER)
DETAIL OF SPIDER MAKE 1 THUS OF 24 GA. SPRING BRASS. (ATTACH TO ARBOR FLANGES)...
22 GA. BRASS OR MONEL METAL BAND
7"
SWEAT JOIN
1/2" PLYWOOD
5/8" #6 SCREWS
STANDARD SANDER DISC
OVERLAP
FASTEN THUS TO A REGULAR DISC UNIT
9" DIAM.
3/8"
10°
HARDWOOD
#0 GARNET PAPER
BEVEL-FACE DISCS MADE THUS

FIG. 5
SANDER DISC DETAILS

Novelty and practicability are incorporated into the sanding disk assembly shown in Fig. 3. The attachment to the motor shaft is made with a standard arbor. The spring brass "spider" is held between the flanges of the arbor and the ends of the "legs" are bolted to the sander head. The sanding disks proper are made of ½" plyboard with a 1" metal band around the circumference. Twenty-two gauge brass or monel metal is recommended for the bands, but galvanized iron can be used. The sanding disks attach to the head disk with bayonet type fasteners. Obviously, the bevel-face disk is merely a modification of the regular disks. It is well to make about three regular disks and fit them with a variety of sand-paper.

Any motor capable of withstanding nominal end thrust can be used with this tool. A ⅓ h. p., 3400 r. p. m. motor is especially recommended for this tool, but a ¼ h. p. or ⅓ h. p., 1750 r. p. m. motor will serve satisfactorily.

The small cost involved in building this useful tool should commend it to every home workshop fan. It will save hours of time and plenty of "elbow grease" when large surfaces must be smoothed.

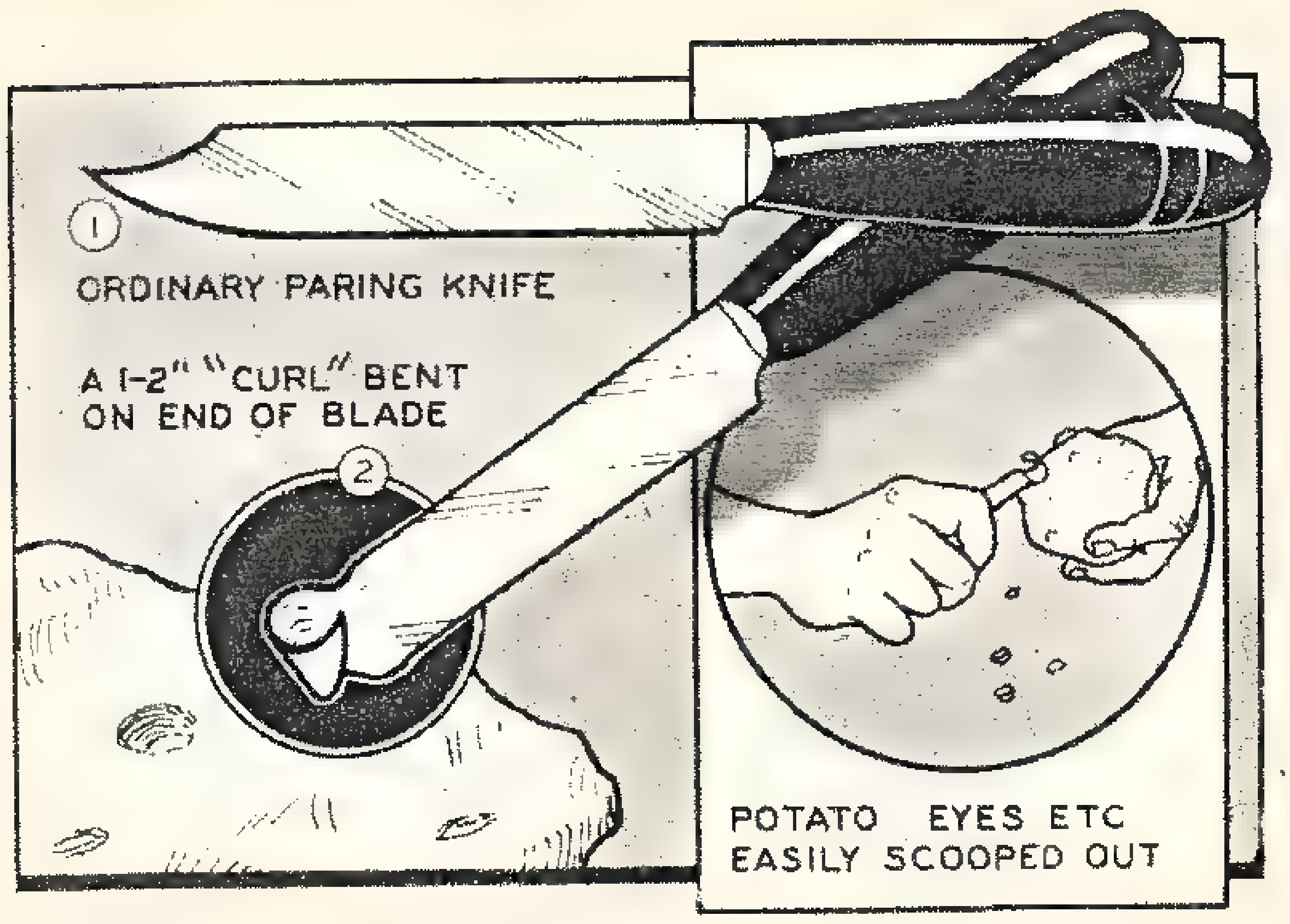
Those who have had to sand down a table top, particularly a large one, know that considerable effort was necessary before the desired result was obtained. With this tool, all the work is done by the motor, the operator merely moving it over the area to be smoothed. If a coat of enamel is applied to the tool, the finished job will not only be useful, but will present an attractive appearance.

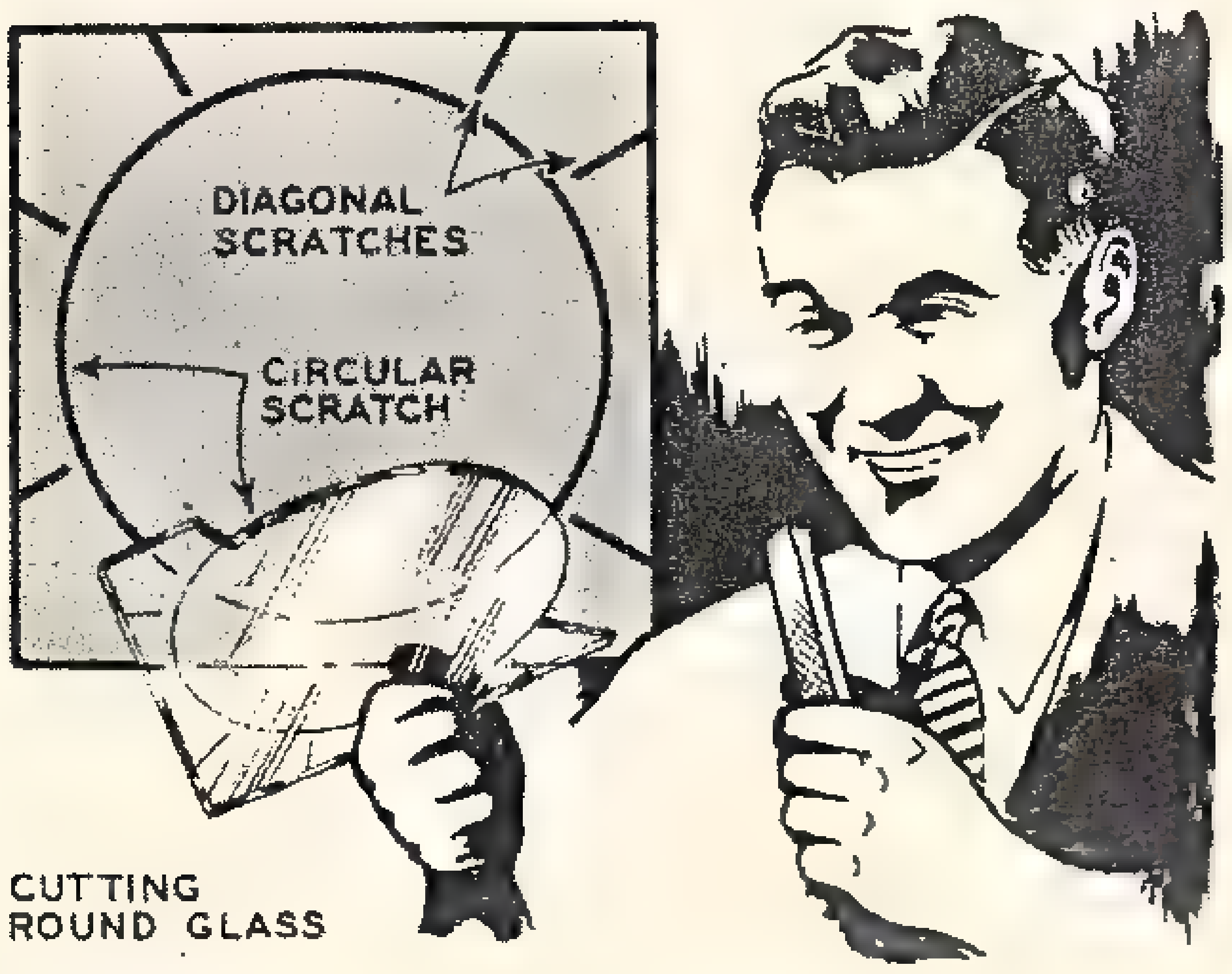
As shown in the photograph, the sander can be attached to a drill press column without disturbing the drill. This is particularly helpful when extra space is not available in the workshop. When the sander is not in use, it will take up very little room.

Time-Saving Handikinks

Bend Improves Paring Knife

A SMALL loop bent in the end of a paring knife will increase greatly its value when preparing fruit and vegetables. Before the bend is made, the end of the blade should be heated to a dull red. A metal rod or heavy bolt should be used as a form around which the bend can be made. If the edge has become dulled because of the heat it can be sharpened with the aid of a small file. If the heat has removed the temper, heat it again and plunge it into cold water. In use, the small loop will be very helpful.


①
ORDINARY PARING KNIFE
A 1-2" "CURL" BENT ON END OF BLADE
②
POTATO EYES ETC EASILY SCOOPED OUT

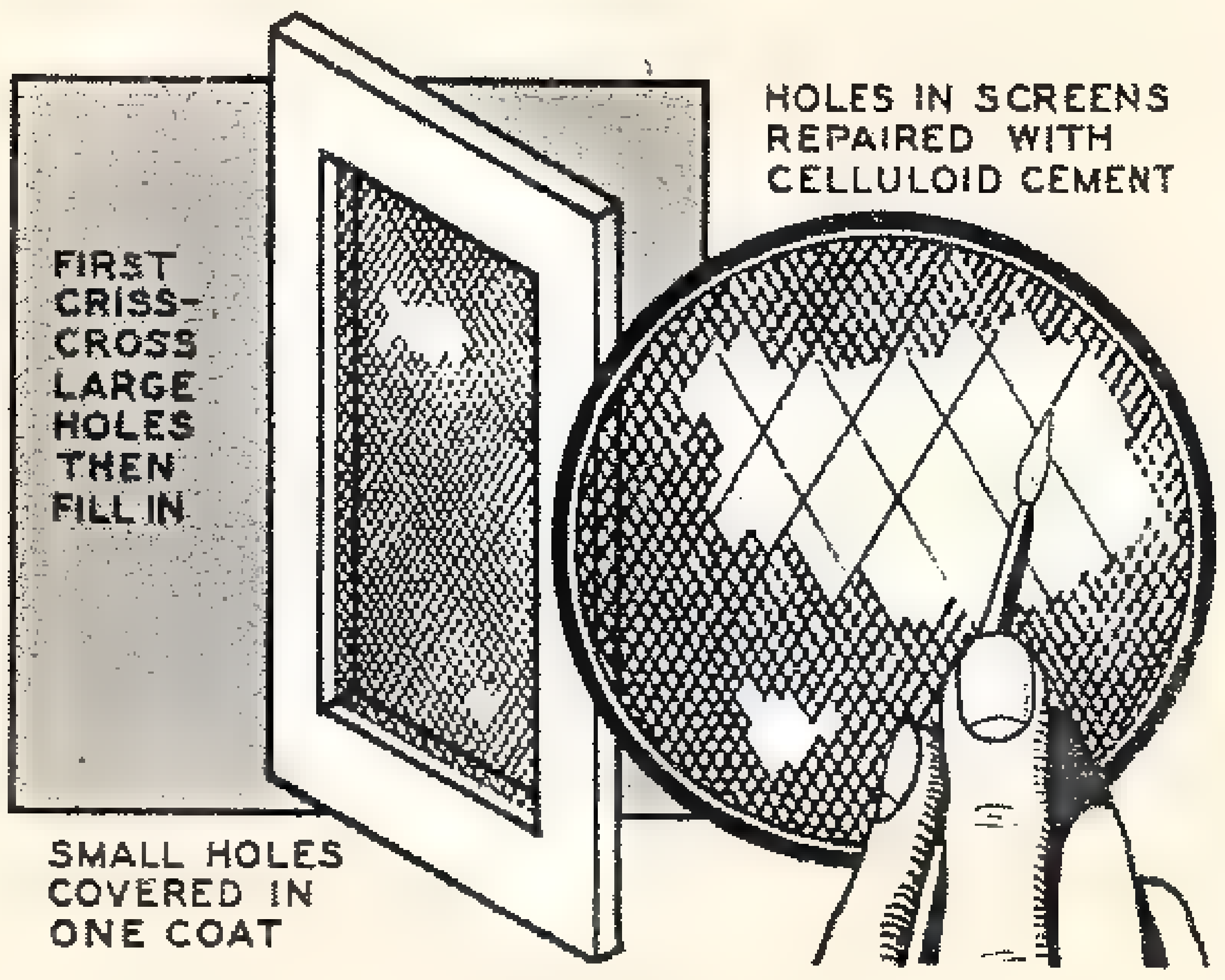

DIAGONAL SCRATCHES
CIRCULAR SCRATCH
CUTTING ROUND GLASS

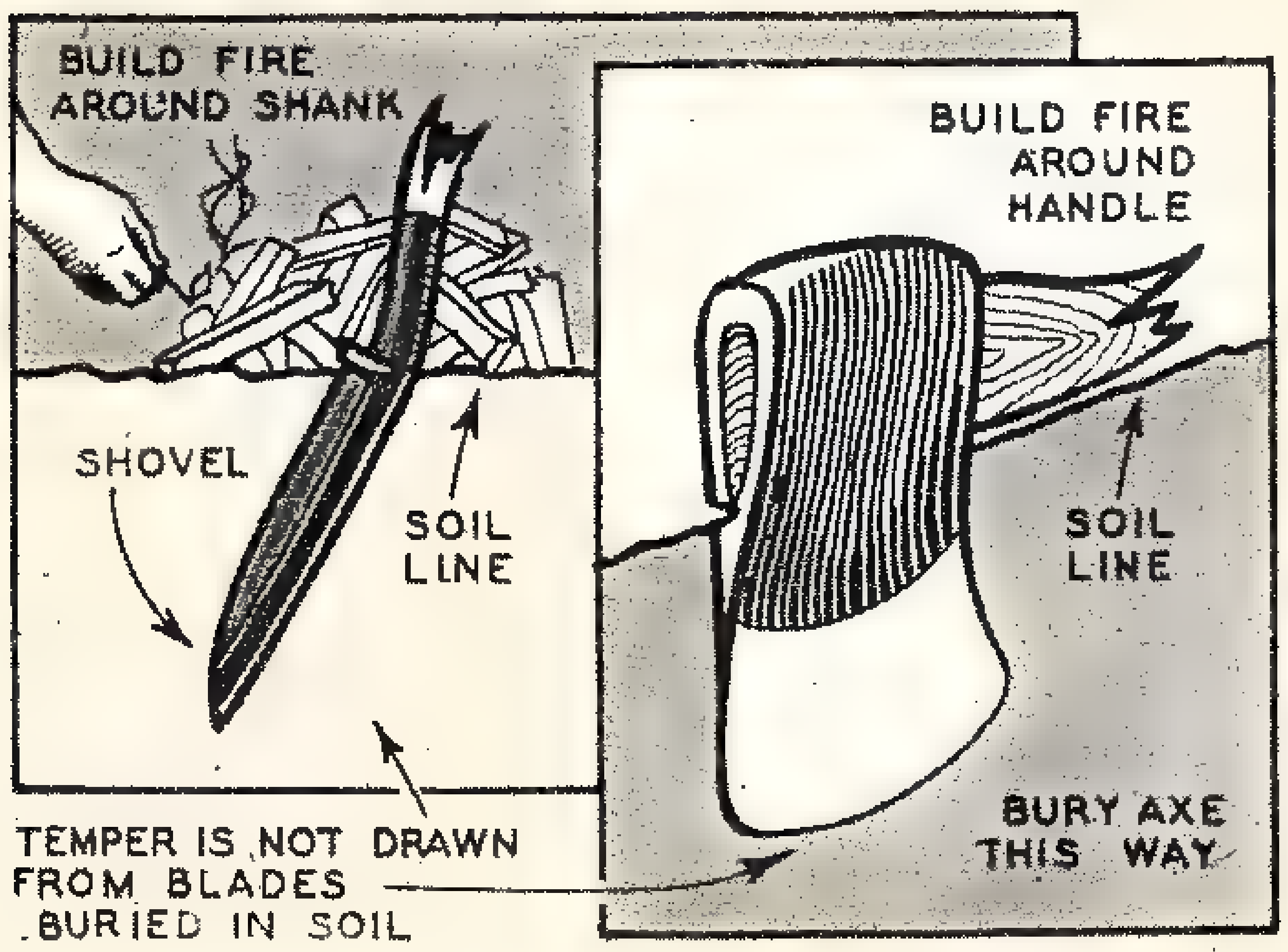
Scratches Aid Circular Cutting

ONE of the most difficult problems for the home mechanic is that of cutting circles in glass. The correct procedure is as follows: Scratch the circle in the glass with a glass cutter or the sharp end of a file. Then make several diagonal cuts from the edge of the glass almost to the circular scratch. Be sure that the diagonal marks do not touch the circle, or when the glass is broken the break will continue through the circular section. Tap the edge with a metal object and one section at a time will break off.

Celluloid Cement Repairs Screens

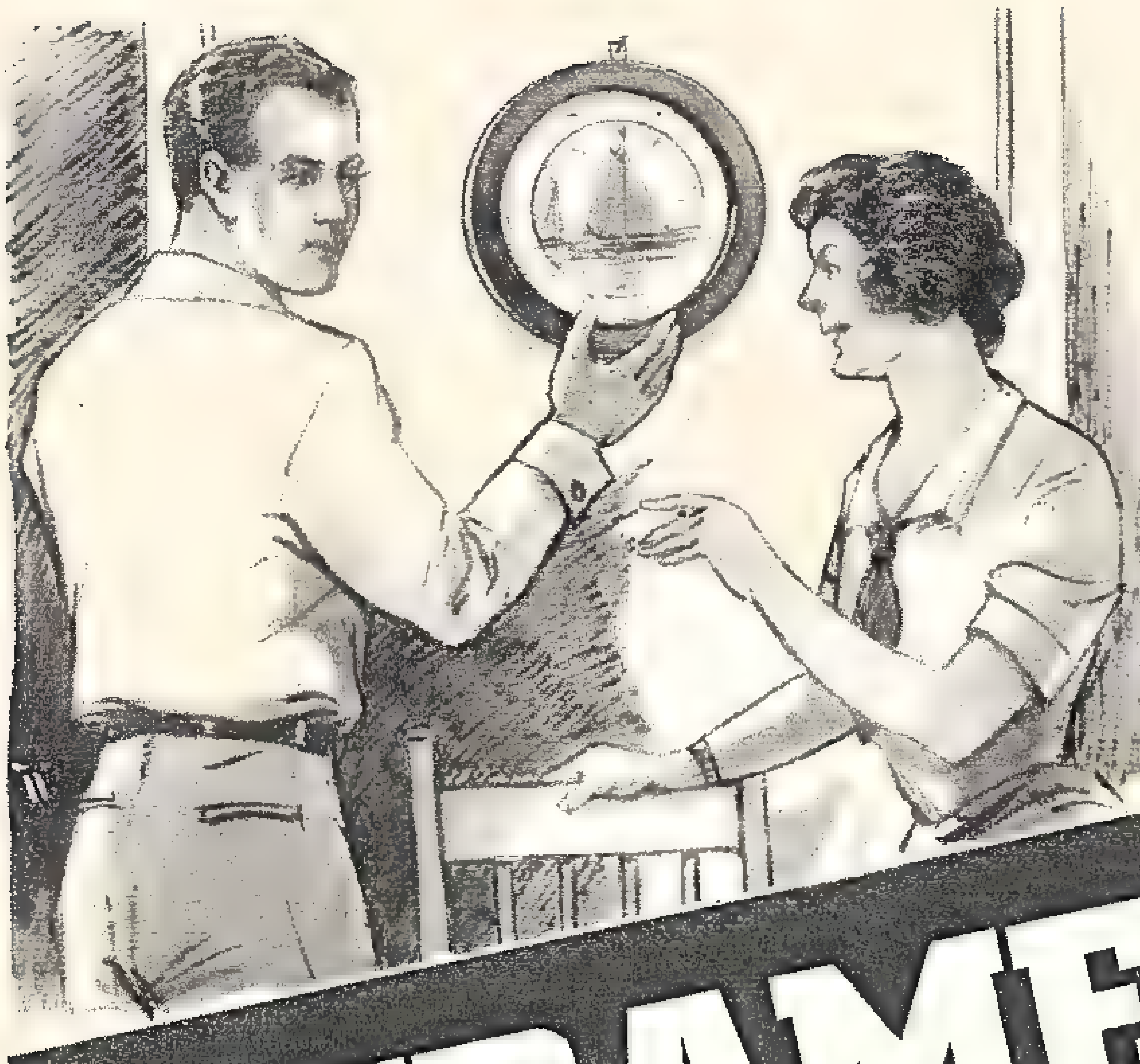
CELLULOID cement will be found very useful for patching up holes in screens used for doors and windows. Holes up to one-half inch in diameter can be filled in easily with one coat. Larger holes should be criss-crossed first as shown in the drawing, and then filled in. When dry the film is translucent, strong and withstands weather. It also has the advantage of covering the sharp edges of the screen so that clothing will not be torn or hands scratched. Be sure to give the cement time to dry before applying a second coat. Several coats will build up considerable thickness.

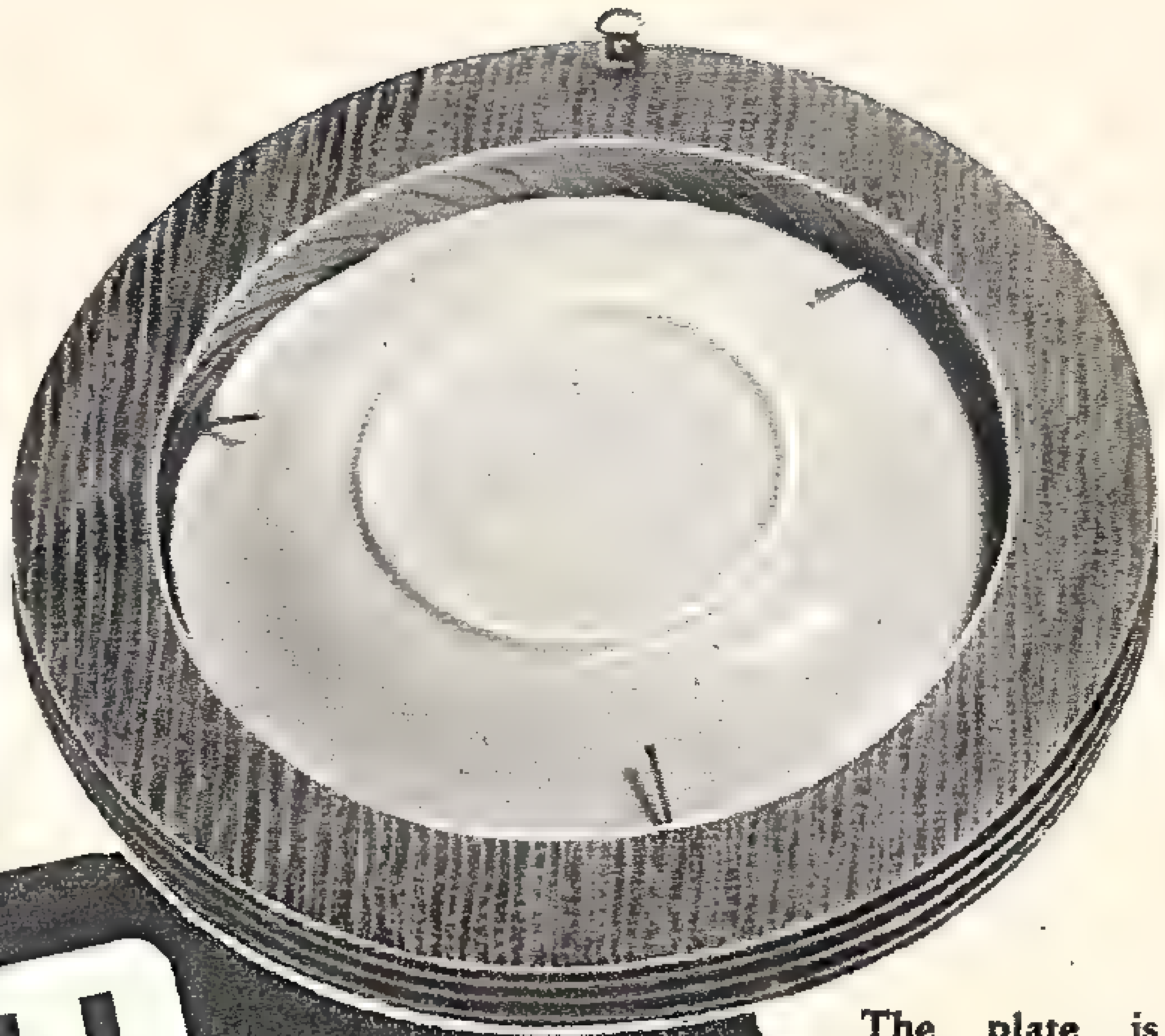

HOLES IN SCREENS REPAIRED WITH CELLULOID CEMENT
FIRST CRISS-CROSS LARGE HOLES THEN FILL IN
SMALL HOLES COVERED IN ONE COAT


BUILD FIRE AROUND SHANK
SHOVEL
SOIL LINE
BUILD FIRE AROUND HANDLE
SOIL LINE
BURY AXE THIS WAY
TEMPER IS NOT DRAWN FROM BLADES BURIED IN SOIL

Fire Removes Broken Handles

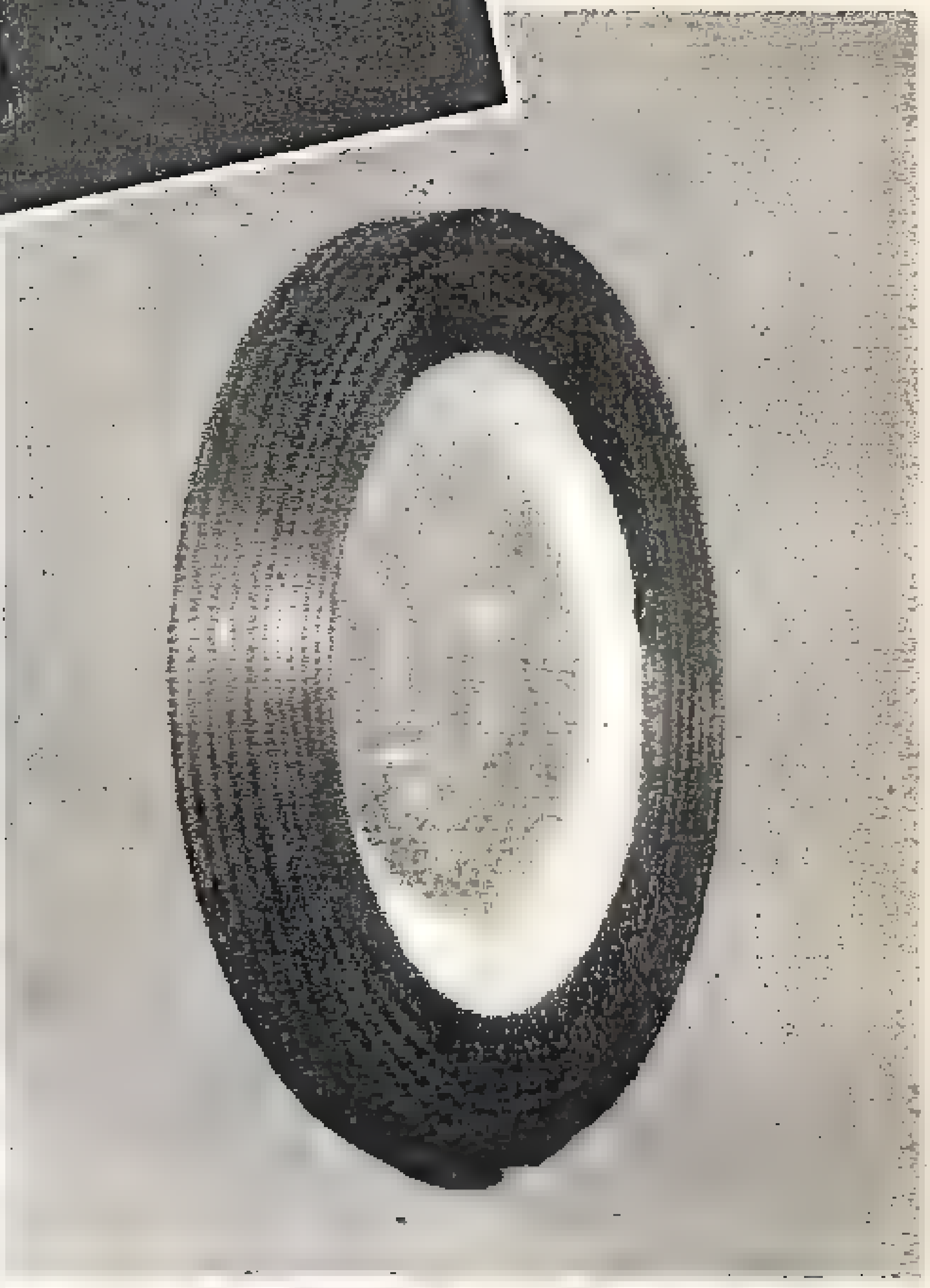
WHEN the handle of an axe, shovel, hoe or other implement breaks off, many times it is difficult to remove the wood without burning and the resultant danger of drawing the temper from the metal. This danger can be removed by burying the blade, or at least the tempered portion in the ground up to the part containing the wood. With the blade surrounded by cool earth, the heat is conducted away, thus preventing the metal from softening and losing its temper.





FRAMED CHINA DISHES

The plate is held in ring with small brads (above). Picture hangers hold frame to wall (below).



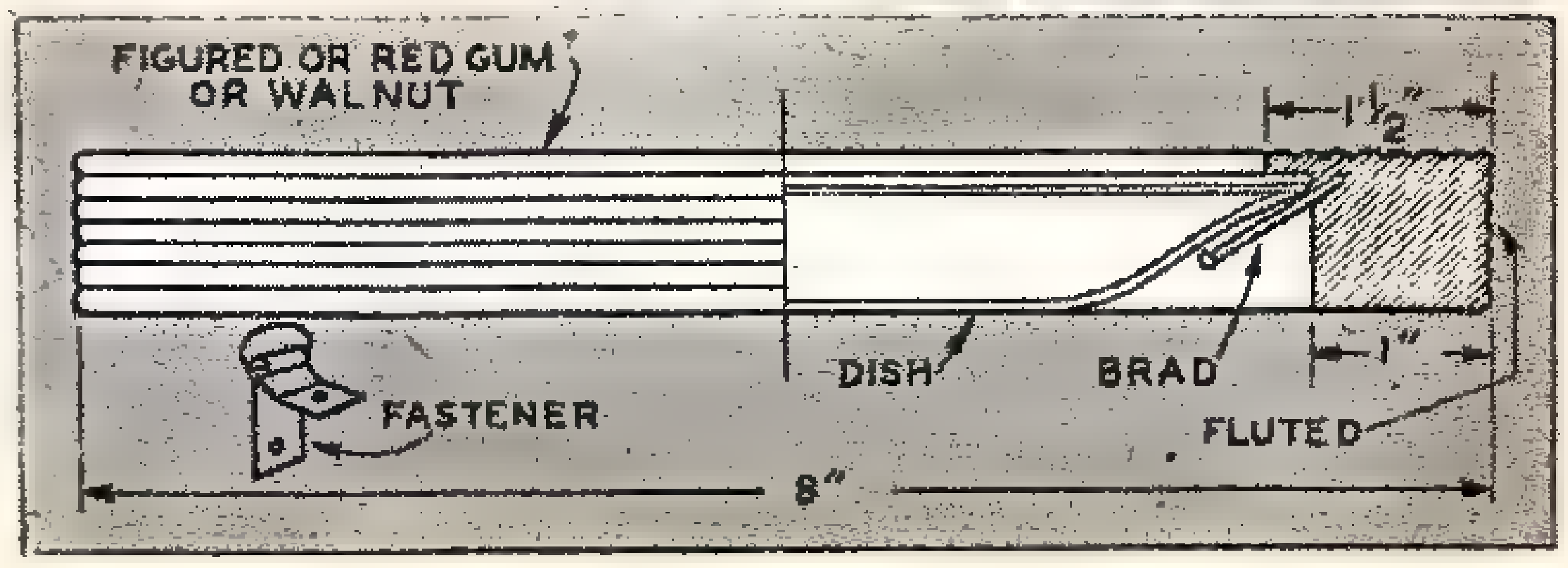
Providing decorative charm that will brighten any bare strip of wall (top), framed china pictures are easily made. The wood stock is turned on a lathe, the rings being cut (right) so that they are one-quarter-inch thicker than the height of the dishes they will frame. This insures the frames lying flat against the wall when completed.

THE simplicity and charm of framed china dishes, which are imprinted with pictures, make them an ideal one-evening project for the craftsman. Their decorative beauty will brighten any strip of bare wall.

The size of the ring frames is governed by the diameter of the dishes used. Use any wood stock and turn it on a lathe, making sure that the finished rings will be at least one-quarter inch thicker than the height of the dishes so as to permit the frame to lie flat against the wall after the dishes are inserted. After cutting the back recess to fit the dishes, the edges and front faces of the rings are fluted, sanded and finished.

The ring centers are removed easily with a small skew chisel held on edge and the resultant rough inside ring edges are then sanded as smooth as possible.

After cutting the back recess in each ring to fit the dish, the edge and the front face of each ring are fluted (right) and then sanded smooth for finishing. The sketch below shows how the dish is held within the ring frame by brads. The sketch also gives the dimensions of the ring edge and recess. The diameter of the ring is necessarily dependent on the diameter of the dishes used.

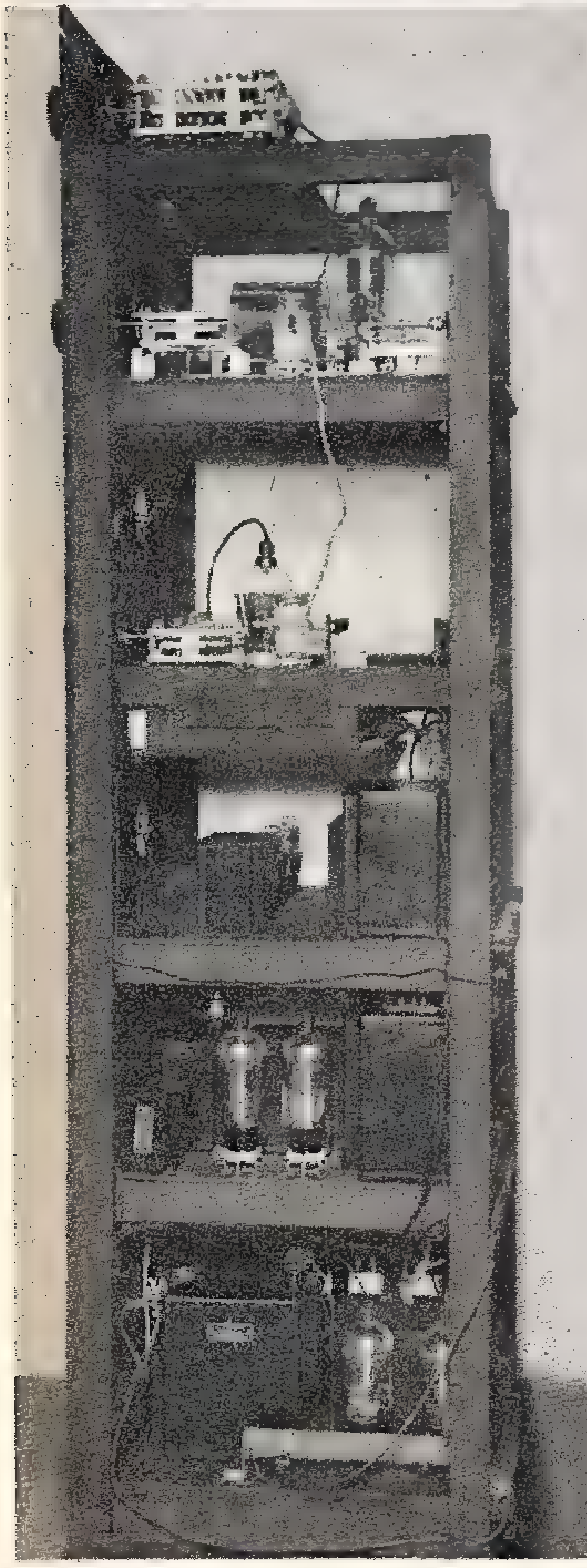


The MM Short-Wave TRANSMITTER

PART III

by

Clifford Peters



A side view of the completed transmitter. The two bottom shelves hold the power supplies. The driver and modulator are on the third shelf. The next two shelves hold the radio frequency section. The antenna tuning unit is at the top. Above is a front view of the transmitter. All dials are insulated from the condenser shafts by flexible couplings and short insulator rods.

ALMOST every amateur at some time finds himself with a desire to go on phone. Those who constructed the transmitter described in the February and March issues will find this modulator and speech amplifier ideally suited to the rig.

The tube line up shown will permit the modulator to “loaf along” and still give 100 per cent, or the more correct 95 per cent, modulation. With no need for working the equipment up to its limit, the quality will be excellent, with a minimum of troubles to clear up.

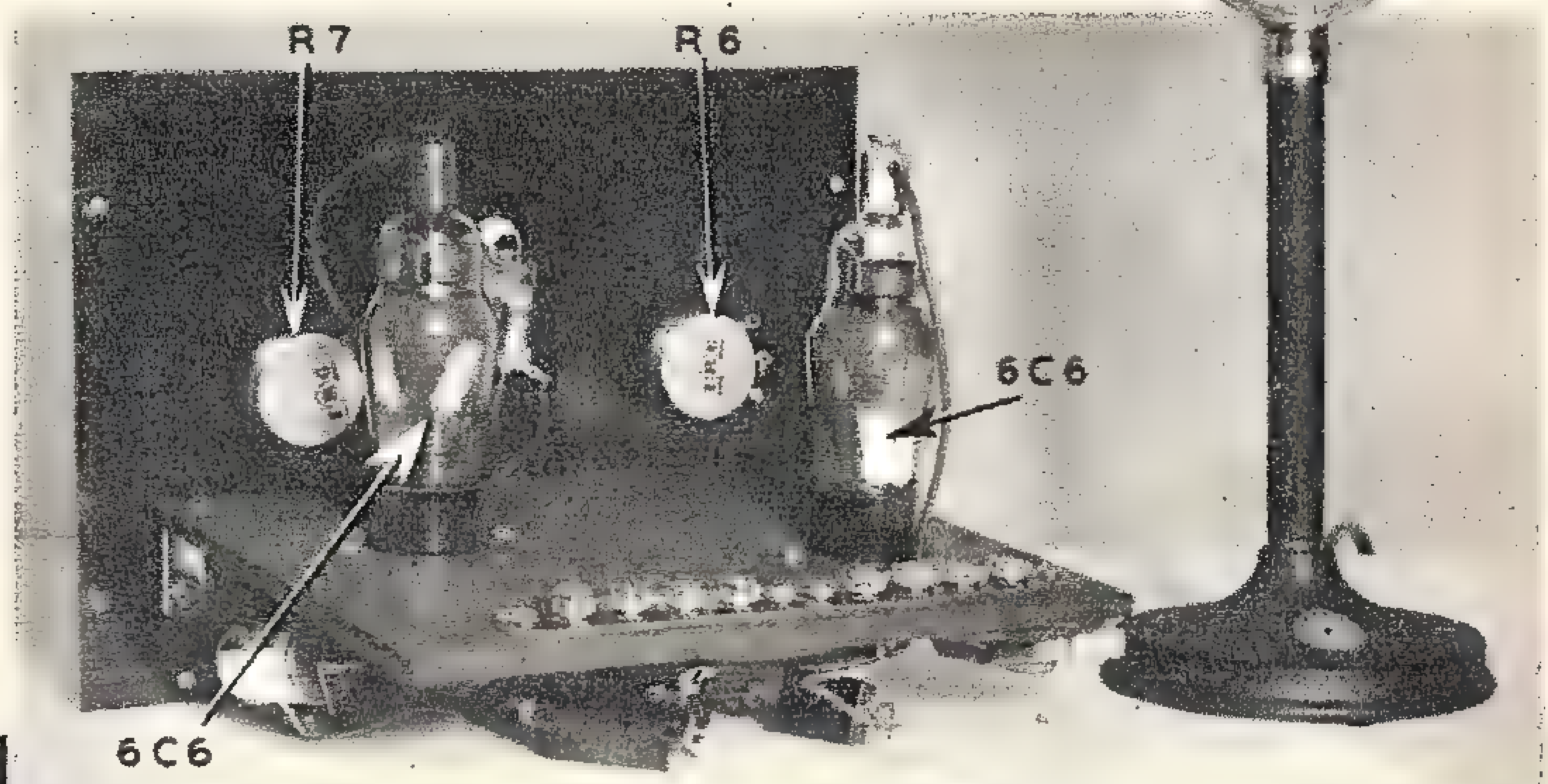
Two power supplies were used; one for the speech amplifier and driver, and one for the modulator. The small supply should deliver 400 volts to the drivers, with approximately 275 volts for the speech amplifier. This can be obtained either by tapping off the bleeder, or by a dropping resistor.

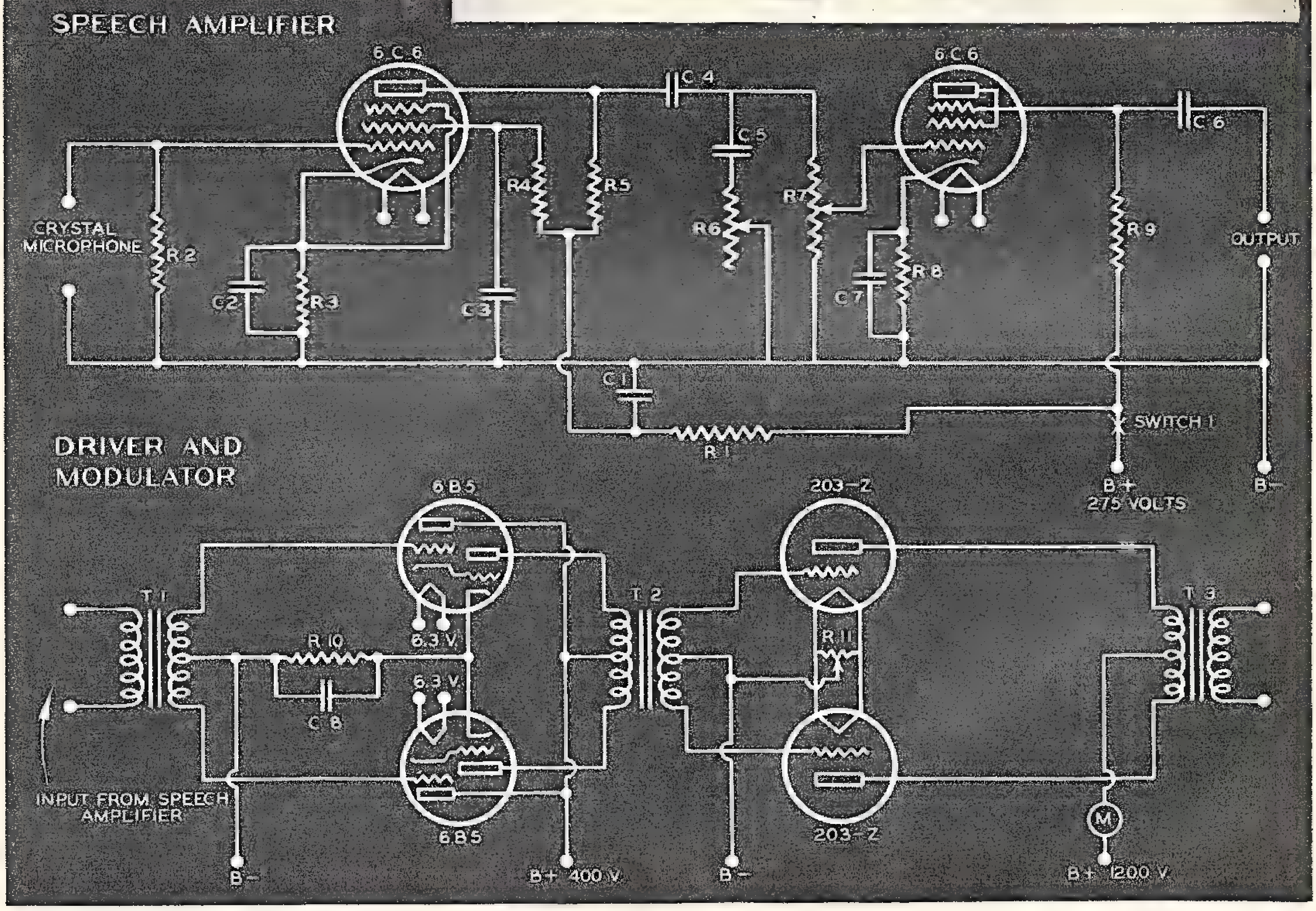
The modulator was laid out to give plenty of room between parts. The filament trans-

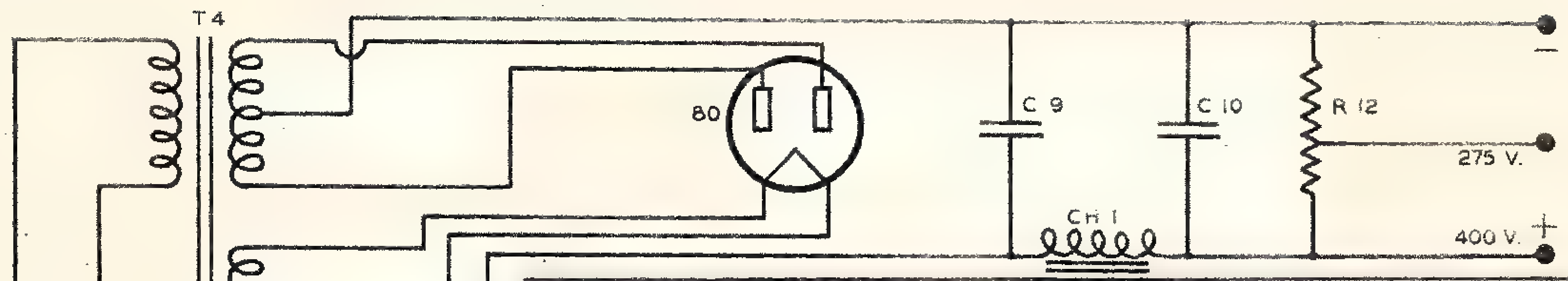
PARTS REQUIRED

R1 50,000 ohms (IRC BT-2)
R2 4 megohms (IRC BT-2)
R3 1,000 ohms (IRC BT-2)
R4 2 megohms (IRC B-2)
R5 500,000 ohms (IRC BT-2)
R6 500,000 ohms ton control (IRC 11-133)
R7 500,000 ohms volume control (IRC 11-133)
R8 1,000 ohms (IRC BT-2)
R9 100,000 ohms (IRC BT-2)
R10 150 ohms (IRC BT-2)
R11 60 ohms center tap (IRC M-832)
R12 40,000 ohms (IRC EPA)
R13 100,000 ohms (IRC HOA)
C1 .5 mf. (receiving type)
C2 25 mf. 50-volt working (Aerovox)
C3 .1 mf. receiving type
C4 .02 mf. (Aerovox receiving type)
C5 .005 mf. (Solar receiving type)
C6 .1 mf. receiving type
C7 25 mf. 50-volt working (Aerovox)
C8 25 mf. 50-volt working (Aerovox)
C9 2 mf. 1,000-volt working Cornell-Dubilier TJ-10020)
C10 2 mf. 1,000-volt working (Cornell-Dubilier TJ-10020)
C11 2 mf. 2,000-volt working
C12 2 mf. 2,000-volt working
T1 Driver input transformer (Kenyon T-52)
T2 Driver transformer (Kenyon T-263)
T3 Class "B" output transformer (Kenyon T-465)
T4 425-0-425-volt, 6.3 volt, 6.3 volt, 5-volt secondaries (Kenyon T-244)
T5 1460-0-1460-volt (Kenyon T-666)
T6 2.5-volt, 10 ampere, (Kenyon T-360)
T7 10-volt, 8-ampere (Kenyon T-361)
Ch1 Filter choke (Kenyon T-154)
Ch2 5-18 henry swinging choke (Kenyon T-513)
Ch3 10 henry filter choke (Kenyon T-176)
Crystal microphone (Shure Brothers 70-5)
Four 6-prong sockets (Hammarlund S-6)
Two 4-prong sockets (Hammarlund S-4)
Two sockets for 203-Z's (ICA No. 956)
Sw1, Sw2, Sw3, Sw4, s. p. s. t. (ICA No. 1230)
Terminal strips, three 4-terminal (ICA No. 2413)
two 2-terminal (ICA No. 2420)
one 6-terminal (ICA No. 2404)
Fuse mounting (ICA No. 2342)
Metal cabinet (ICA No. 3826)
Tubes: two Taylor 203Z
two Taylor 866
two 6B5 (Raytheon)
two 6C6 (Raytheon)
Milliammeter 0-300 (Triplett)
Grid caps (ICA No. 870)
Name plates (ICA)
Dials (ICA No. 2169)
Pointer knobs and dial plates (ICA No. 2240. 2241)

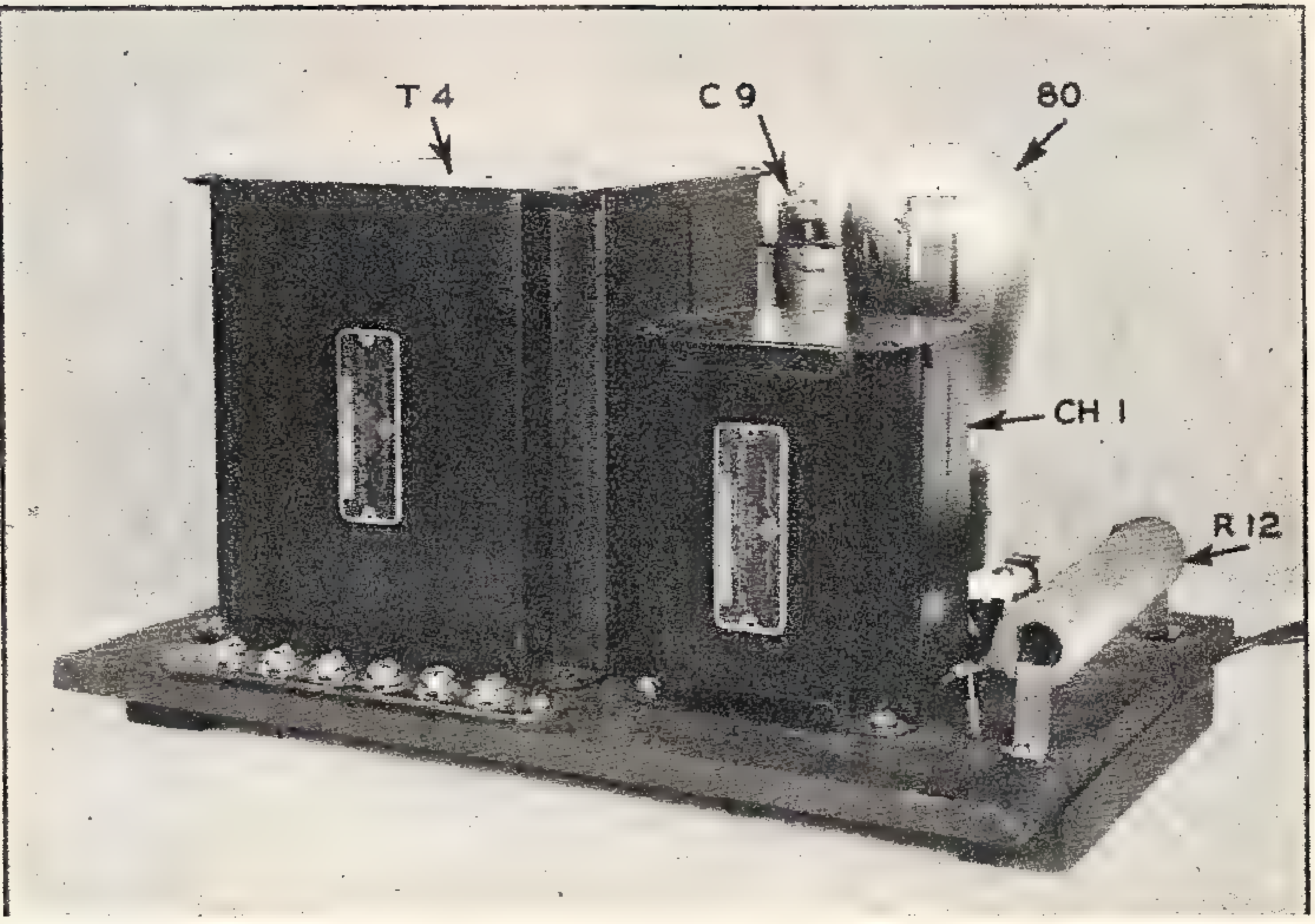
Above is shown a front view of the speech amplifier. Below is the rear view. Tube shields are not shown.


R 7
R 6
6C6
6C6

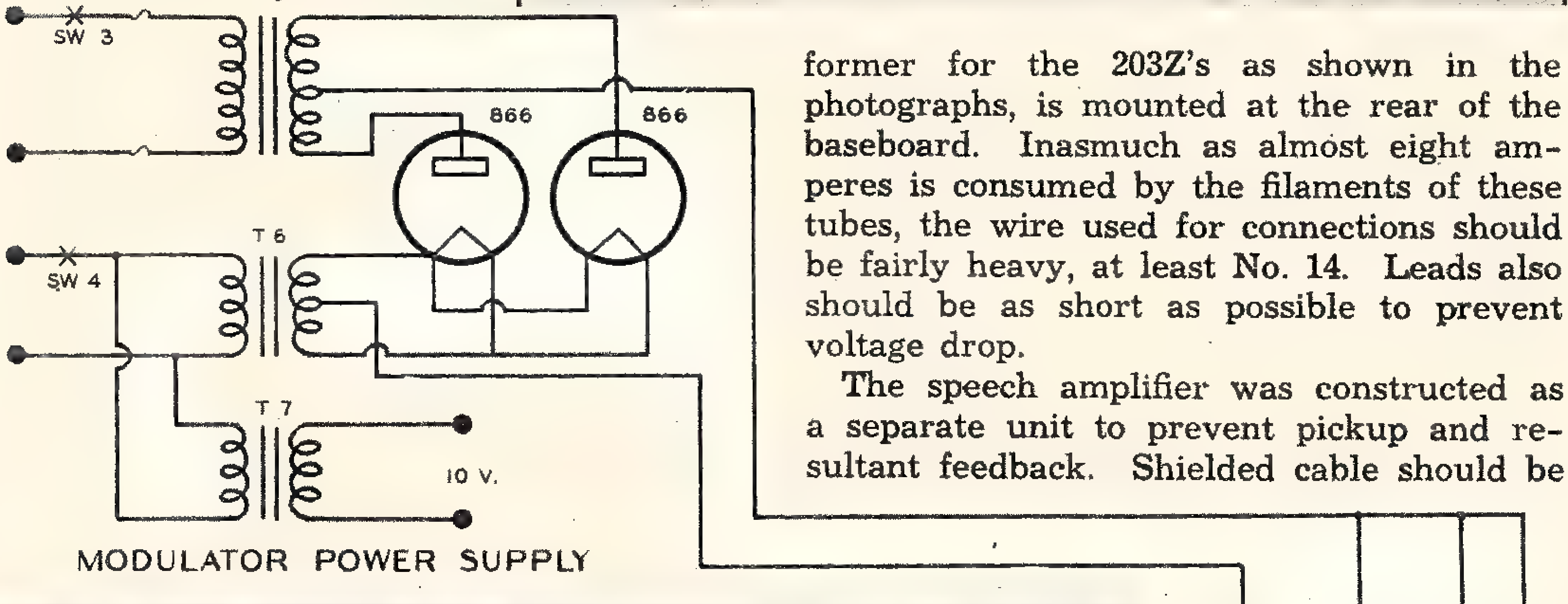

SPEECH AMPLIFIER
6 C 6
C 4
6 C 6
C 5
C 6
R4
R5
R7
R6
CRYSTAL MICROPHONE
R 2
R 9
OUTPUT
R 8
C2
R3
C3
C7
C 1
SWITCH 1
R 1
B+ 275 VOLTS
B−
DRIVER AND MODULATOR
6 B 5
203−Z
T 1
T 2
T 3
R 10
6.3 V.
R 11
6.3 V.
C 8
INPUT FROM SPEECH AMPLIFIER
6 B 5
203−Z
M
B−
B+ 400 V.
B−
B+ 1200 V.


T4
80
C 9
C 10
R 12
CH 1
275 V.
400 V.
SW 2
6.3 V. 6B5'S
6.3 V. 6C6'S

POWER SUPPLY FOR DRIVERS AND SPEECH AMPLIFIER


T 4
C 9
80
CH 1
R 12

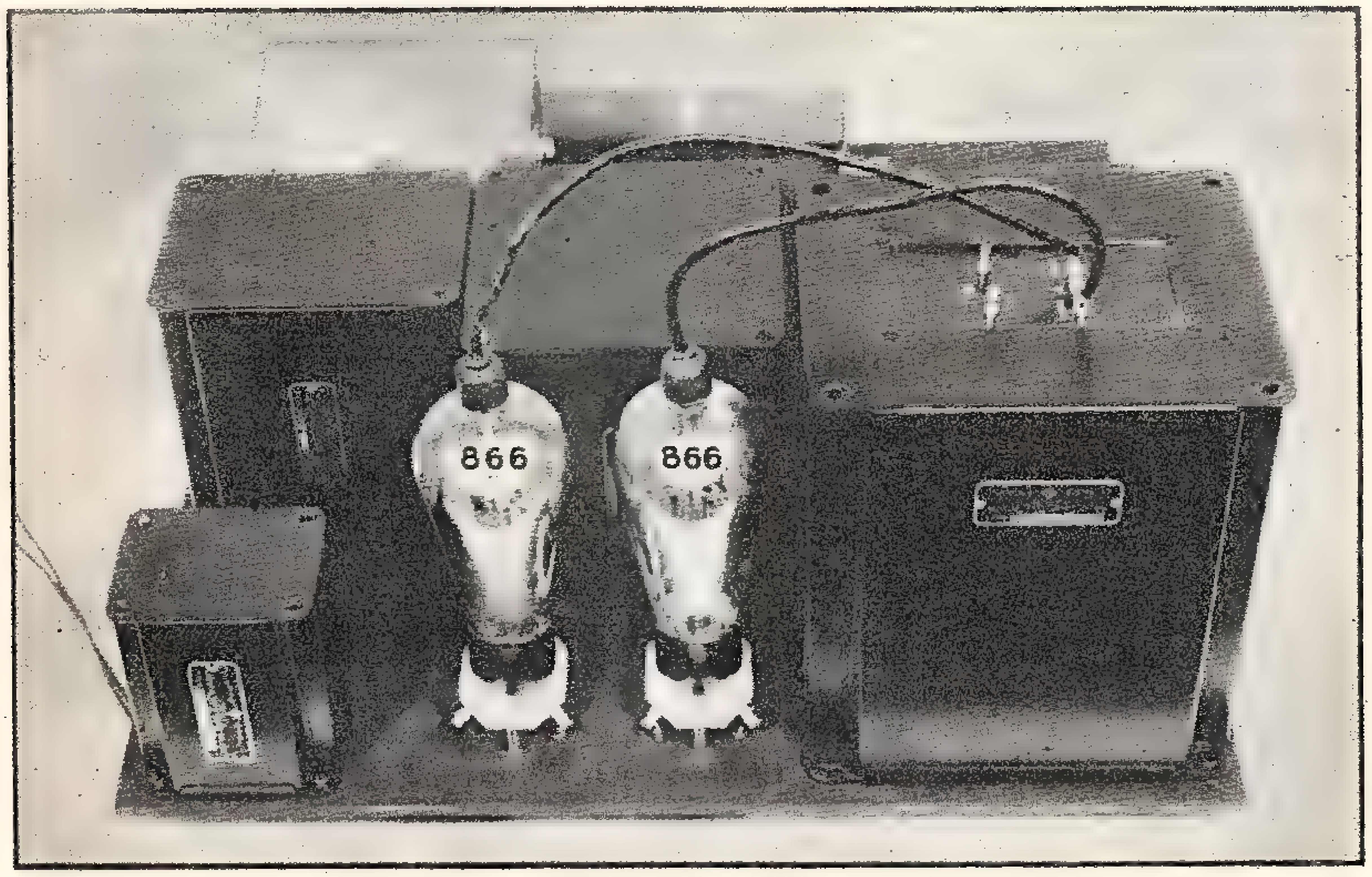
At right is the power supply for the speech amplifier and drivers. T4 supplies filament power for 6C6's and 6B5's.


T 5
SW 3
866
866
T 6
SW 4
T 7
10 V.
C 11
C 12
CH 2
CH 3
R 13
1200 VOLTS

MODULATOR POWER SUPPLY

former for the 203Z's as shown in the photographs, is mounted at the rear of the baseboard. Inasmuch as almost eight amperes is consumed by the filaments of these tubes, the wire used for connections should be fairly heavy, at least No. 14. Leads also should be as short as possible to prevent voltage drop.

The speech amplifier was constructed as a separate unit to prevent pickup and resultant feedback. Shielded cable should be



At left is the power supply for the 203Z modulator tubes. Ch2, the swinging choke, is next to the plate transformer. The bleeder should be adjustable so that plate voltage can be reduced when desired.

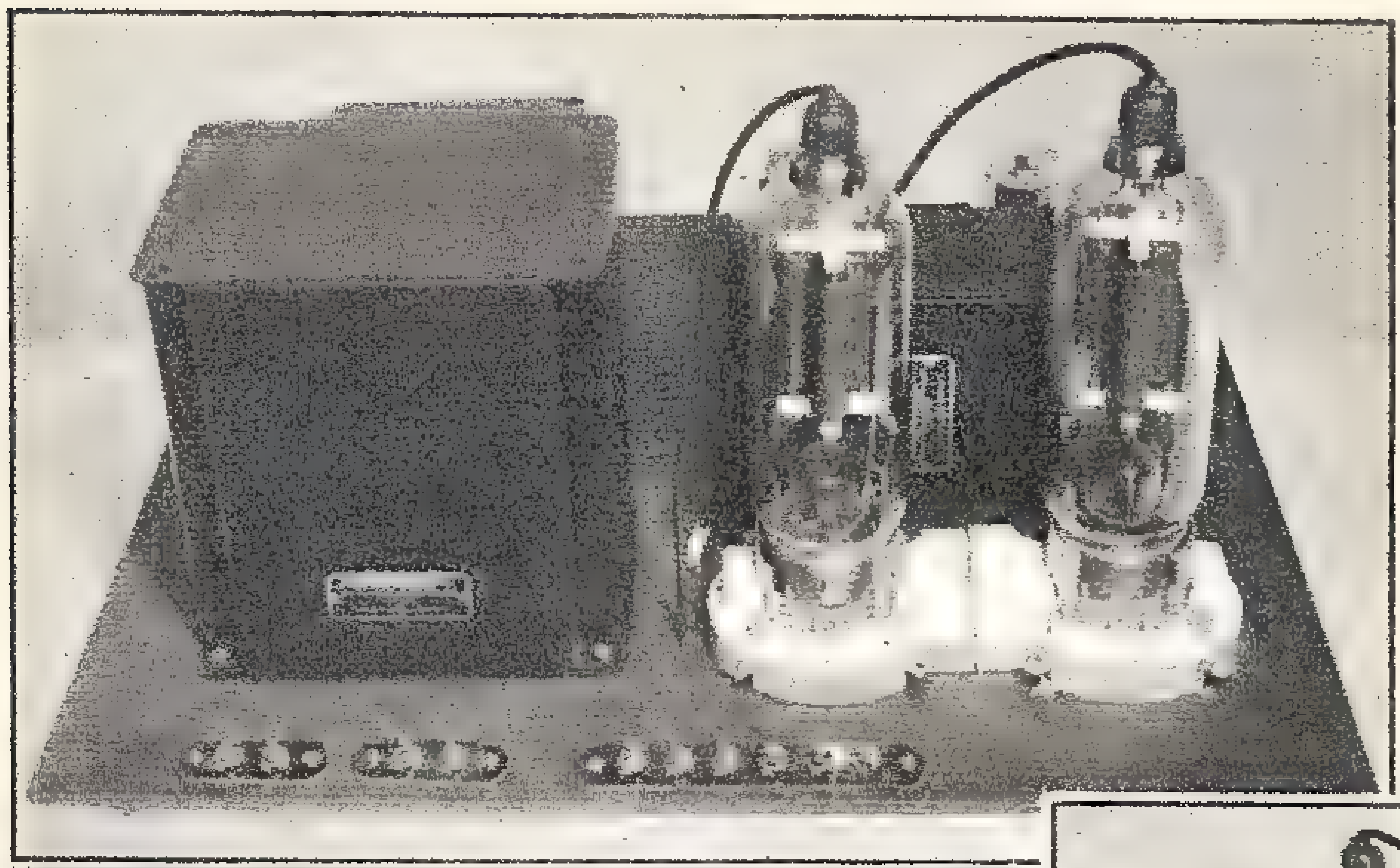
used for connecting it to the driver tubes. Beside the electrical advantage of having the speech amplifier separated from the rest of the transmitter, the operator will find it convenient to have it on the operating table, for easy adjustment of the gain control and the tone control.

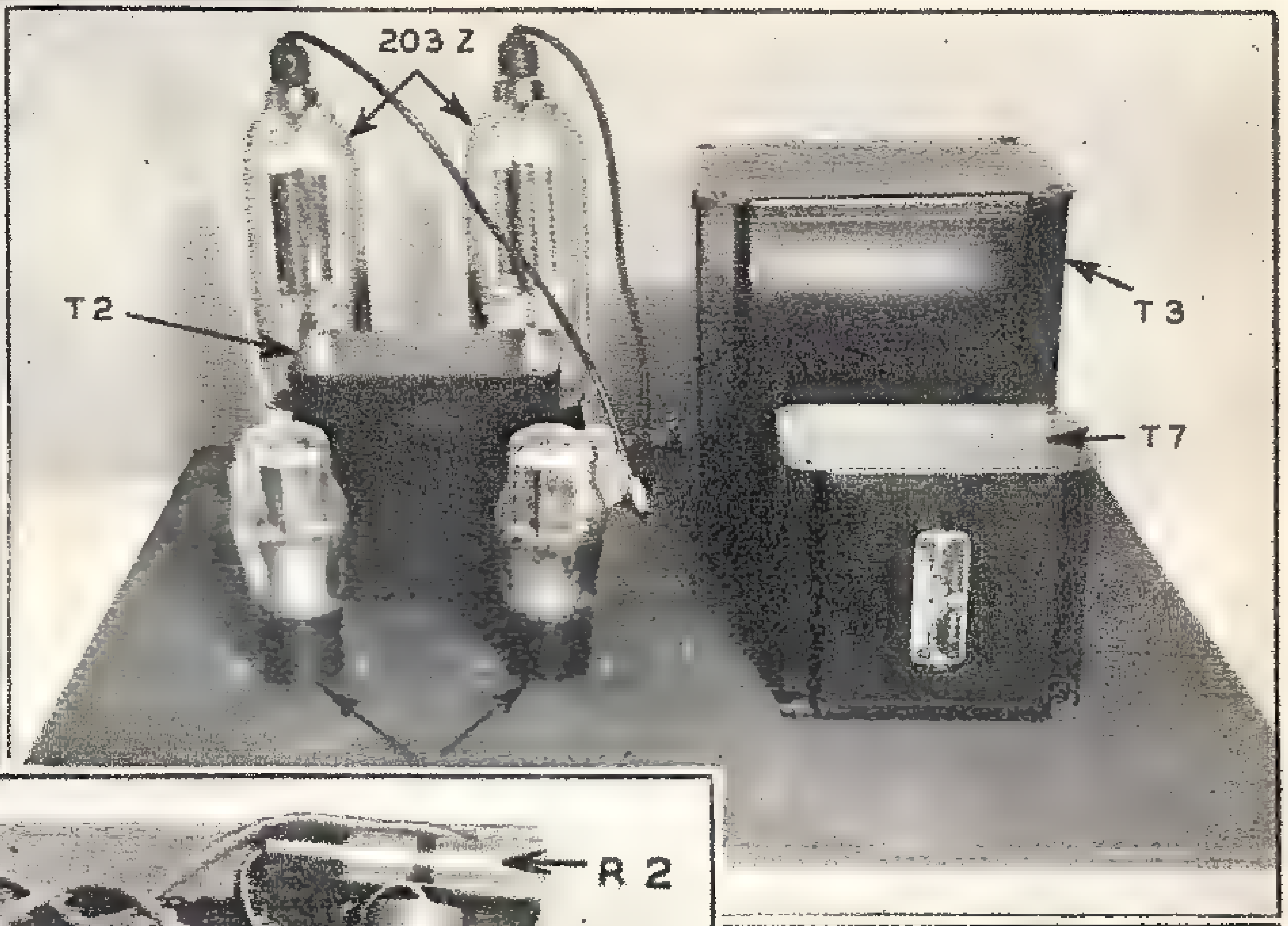
When the gain is turned up high, the tone control will be very useful for cutting out background noises and unnecessary pickup.

The construction details of both the speech amplifier and modulator are simple and little can be said to help the individual builder. The pilot light on the speech amplifier panel is connected in the filament circuit of the 6C6 tubes. If this circuit is connected into the line feeding the rest of the transmitter, it will serve as continual notification that the rig is "alive." When the audio equipment is completed and ready for tests, do not apply power and speak into the microphone unless the modulation transformer has a load applied to it. This can be in the form of a bleeder connected across the terminals and a loudspeaker connected across a very small portion of the resistance.

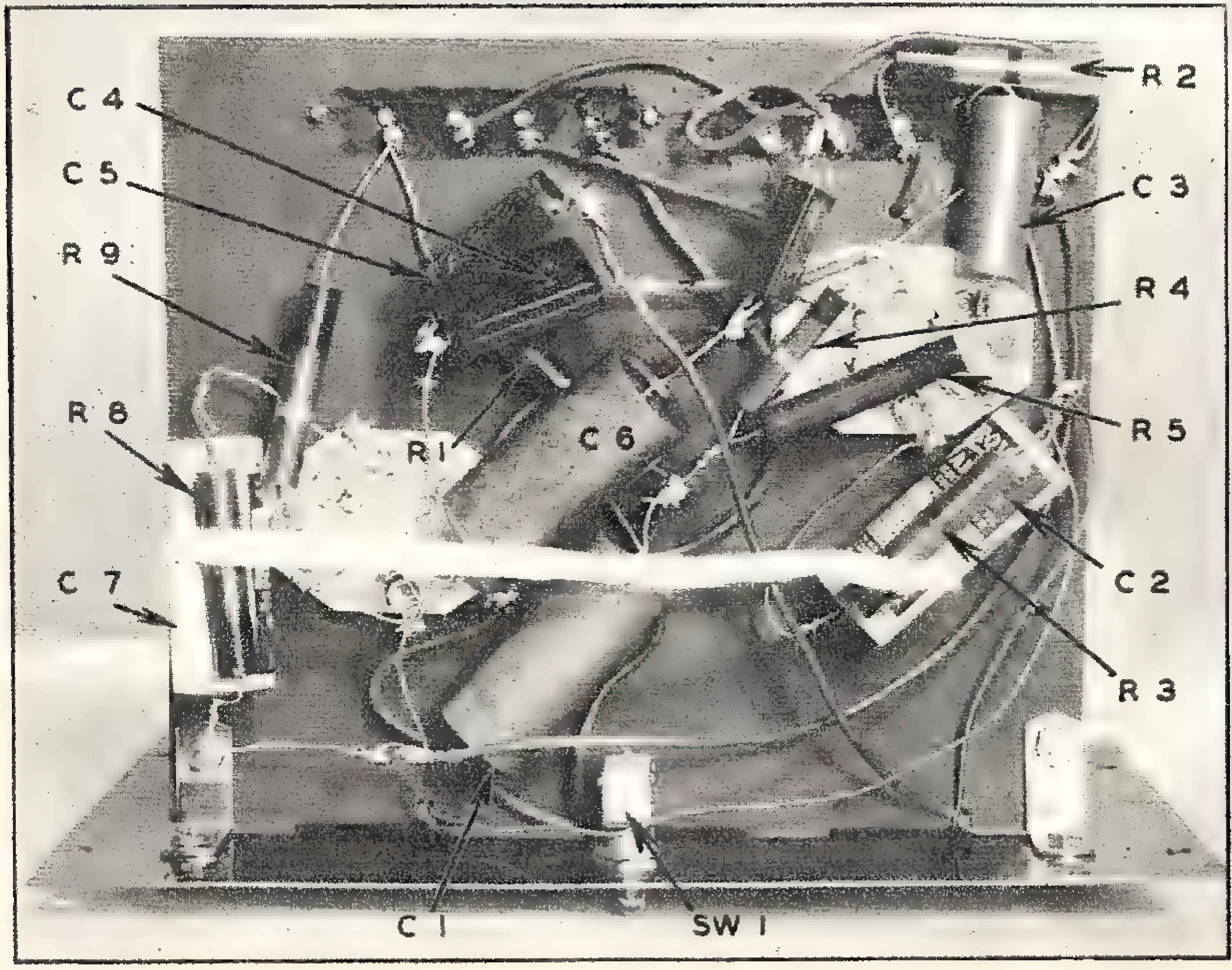
The builder then can test for

[*Continued on page* 118]



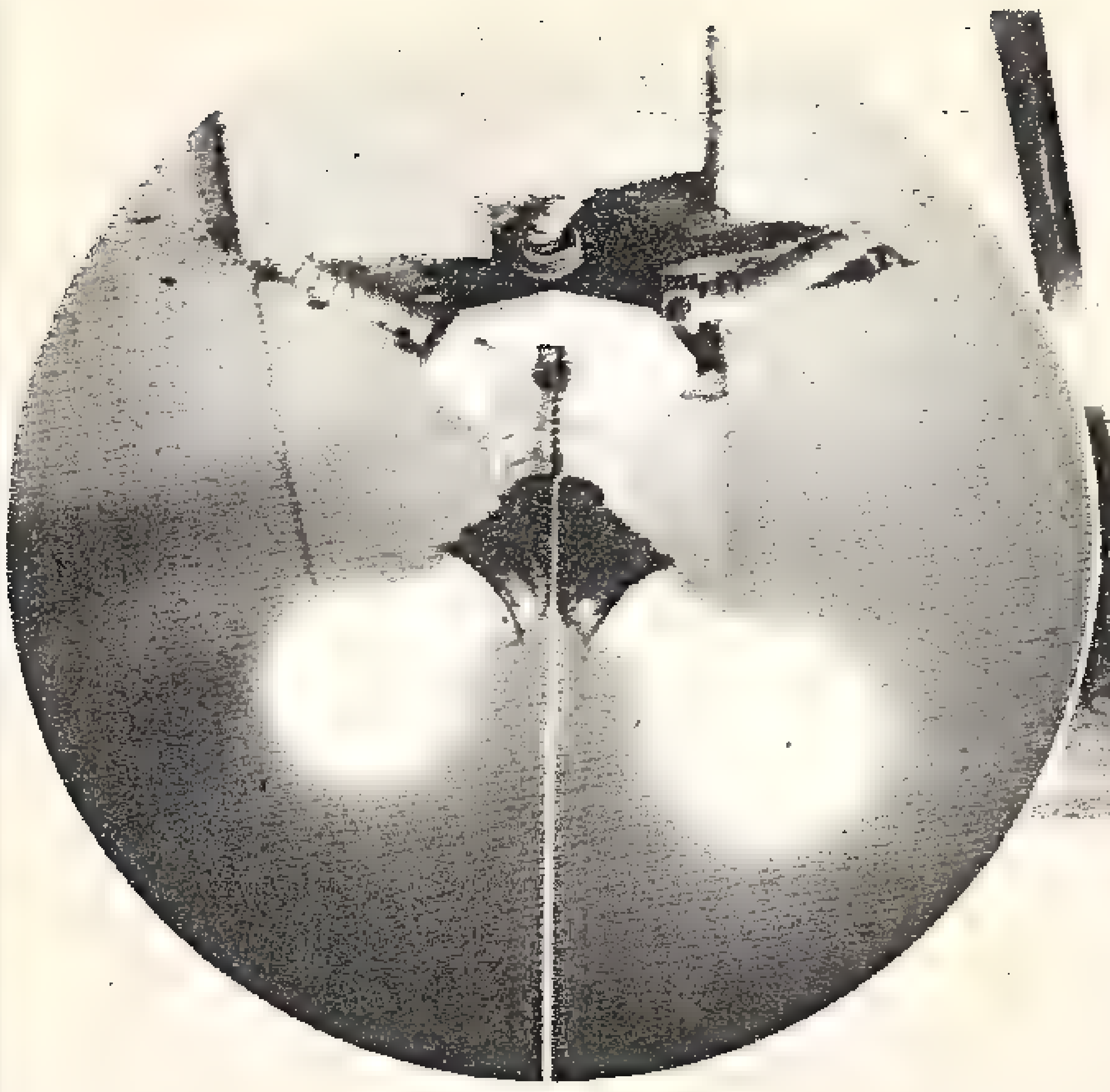


Above is the rear view of the modulator showing the 203Z's and the modulation and driver transformers. When testing, be sure that a load is connected to the output of this stage before speaking into the microphone. At the right is another view showing the 6B5's just behind the driver transformer. T7 supplies power for the 203Z filaments.



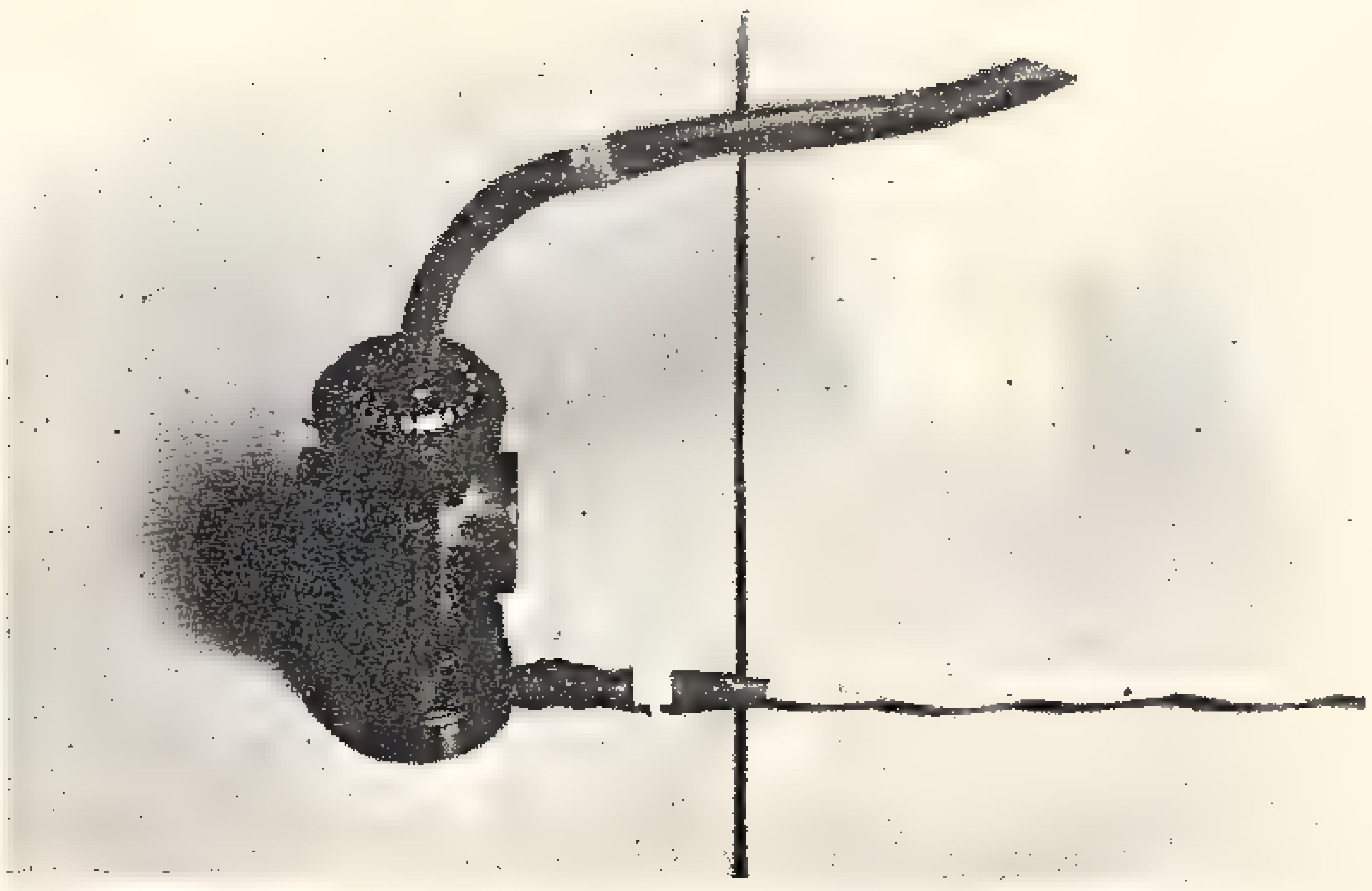
An under view of the speech amplifier. A metal panel and cabinet are used to insure adequate shielding. The lead from the amplifier to the driver stage should be of the shielded type. By connecting pair of phones to output connections, this section can be tested for quality before connecting it to the driver stage.

ELECTRICAL KINKS



Electric lights in cellars, closets, halls and other permanently dark places usually burn out just when needed most. A simple way to avoid this inconvenience is to equip the socket with a V-type double bulb holder (above), using two small 15 watt bulbs instead of a single 25-watt type. The possibility of two bulbs burning out is remote.

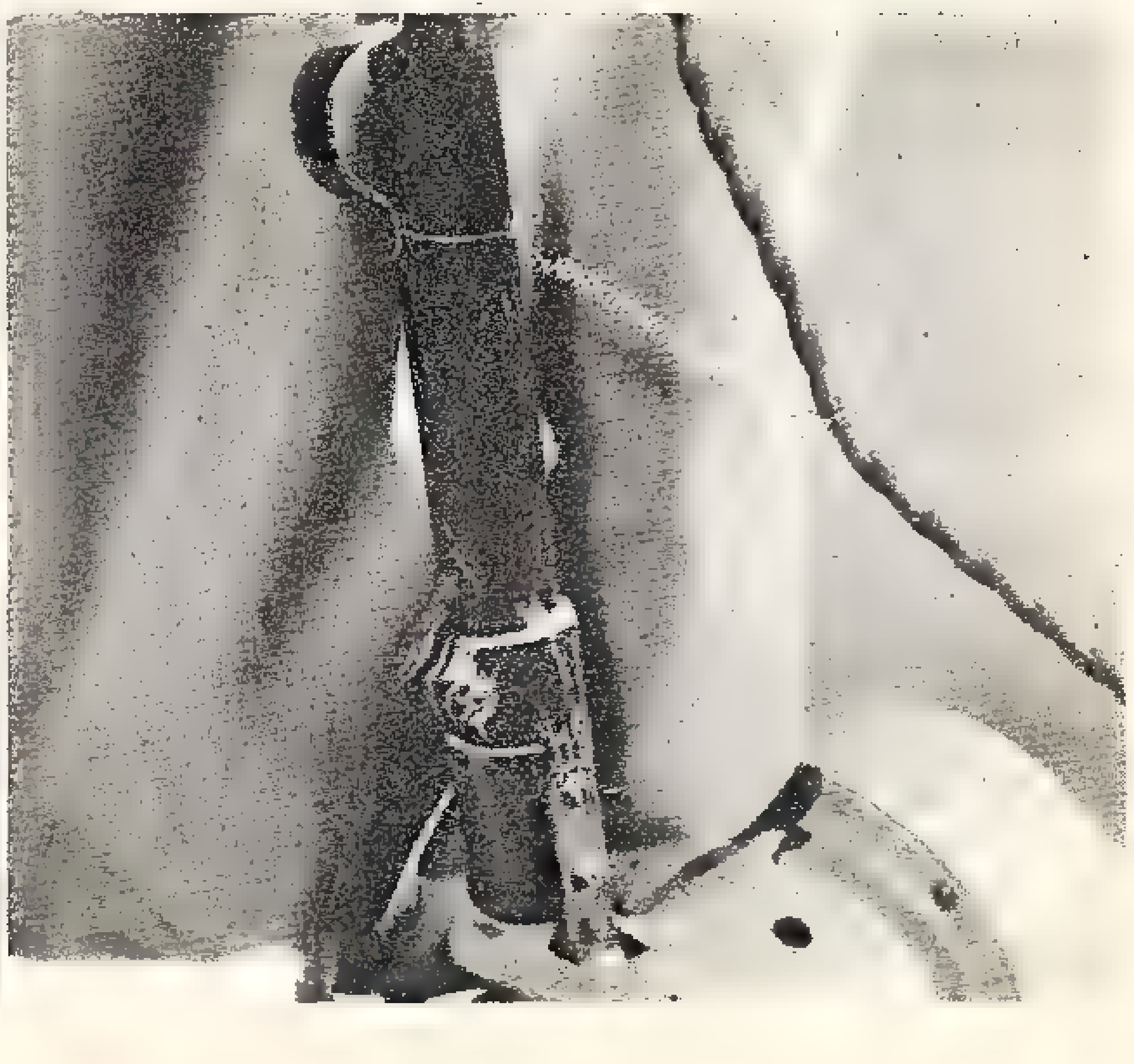
Loose wires from floor lamps, radio receivers, etc., should be kept well separated from radiators and connected piping as the latter are well grounded and if the wire's insulation becomes worn or frayed, the wire will form a dead short circuit against the piping and some unpleasant "fireworks" may result if the house fuses do not blow out quickly enough (above). Hold wires to floor with insulated staples.



Wiring held in place with insulated staples often develops trouble because of breakage of the wire inside the insulation. This is usually caused by heavy hammering on the staples. Cushion the blows of the hammer by wrapping tape around wire before pounding staples in place (above).

Flexible electric cords develop bad kinks because the insulation and covering dry out irregularly while the cord is kept in a tangled heap in a drawer. Avoid this trouble by hanging the cords up neatly when not in use. A good place is the inside of a broom closet or on the door of a folding ironing compartment, as shown in the photograph below.

The tension of a small spring fastened to a vacuum cleaner cord, as shown below, informs the user when the cord has been stretched its full length, enabling user to stop pulling before the cord breaks, arousing housewife's ire.



1st PRIZE

2nd PRIZE

MODERN MECHANIX PHOTOGRAPHY SECTION

PAGES 103-116

3rd PRIZE

4th PRIZE

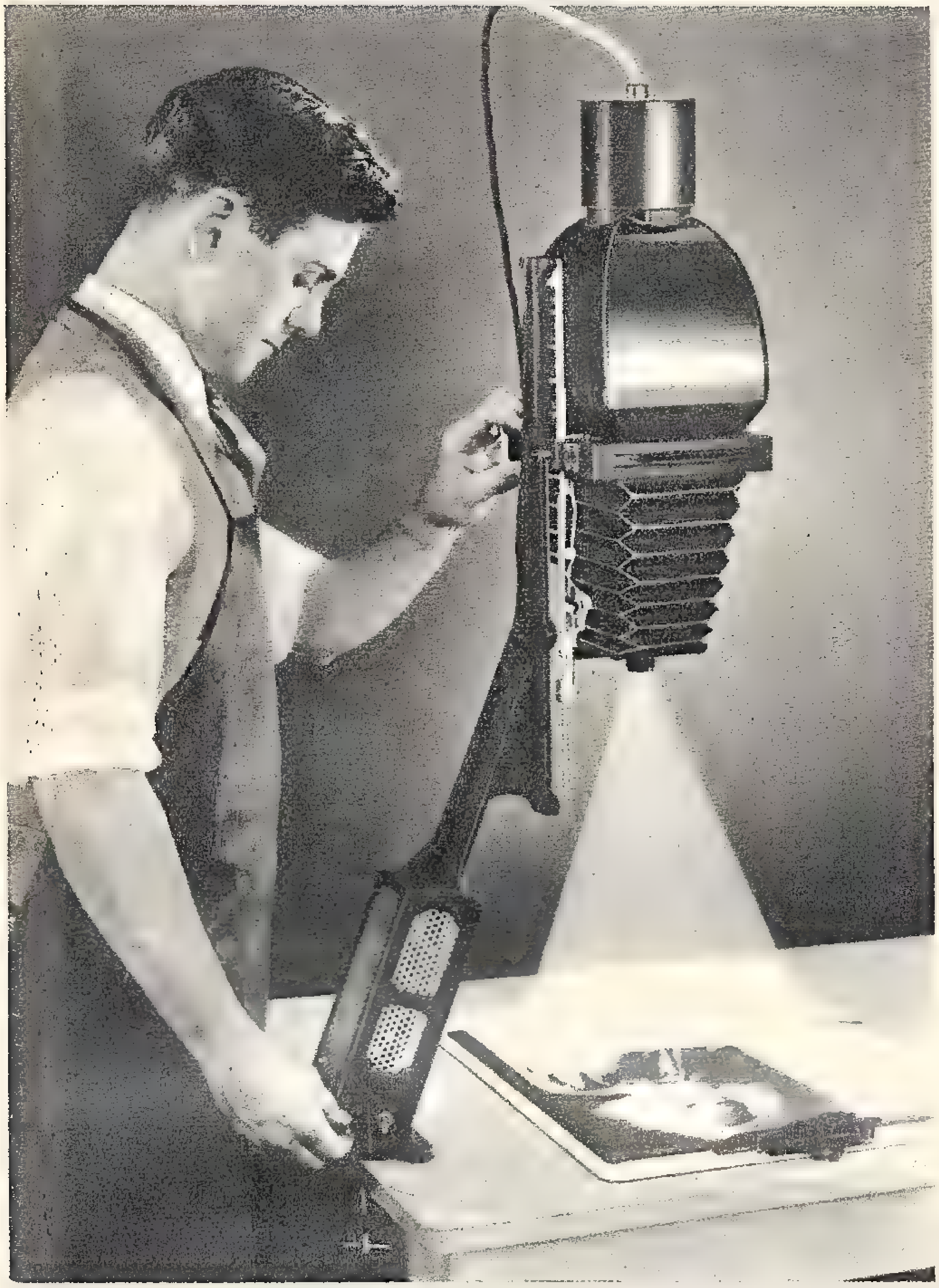
5th PRIZE

FIRST PRIZE—$15—"A Friend in Need is a Friend Indeed." This homeless pup couldn't reach the fountain, so a thoughtful boy helps him to a drink. A fine example of story-telling photography by Andrew C. Bruening, 2613 Hebert St., St. Louis, Mo. Rolleiflex 6 x 6 cm. camera, Eastman S.S. Pan film, 1/50 sec. at f.11. SECOND PRIZE—$10—to Elwood J. Hunemorder, 613 Haley St., Midland, Mich., for catching this deer in such an artistic pose. The "catch" is that the deer is a glass miniature bought for ten cents, the hill is a small pile of sand on a board, and the sun is merely a 60-watt lamp! Exposure, 2½ minutes at f.4.5 on Verichrome film. THIRD PRIZE—$5.00—"Ghost Writing" by Don Brumbaugh, 191 Castlebar Road, Rochester, N. Y. Taken by waving a lighted candle in front of a 2A Kodak with the lens open. FOURTH PRIZE—$5.00—to Joseph Fred Cornett, 601 Union Avenue, Bronx, N. Y., for "Shadows," taken under a beach boardwalk; 1/25 sec. at 6. 6.3. FIFTH PRIZE—$5.00—Spilled milk that isn't going to waste. Robert Olive, Jr., 214 Dobbin Avenue, Fayetteville, N. C., caught pussy at 1/25 sec., f.8, with the help of one photoflood lamp, as the natural light was weak.

MONEY FOR YOUR PICTURES!

Get busy with your camera and send in unusual pictures of people, animals, machines, trains, airplanes, etc. Each month we will pay $15 for the best picture received from readers, $10 for the second choice, and $5 each for the next three selections. Prints should be glossy, as large as possible up to 8x10 inches (although a small, clear photo is more desirable than a big, fuzzy one) and should be accompanied by the following data: make and size of camera, type of film, and how developed and printed, lens opening and shutter speed, and lighting conditions. Wrap all prints carefully and include postage if you want them returned. Address all contributions to Photography Editor, MODERN MECHANIX, 1501 Broadway, New York, N. Y.

How To Make



A typical "auto-focus" enlarger taking negatives up to 4x6 inches. It is readily clamped to the edge of a shelf or table in the dark room. This is a good instrument for the beginner because the automatic focusing action makes it practically foolproof.

CONTRARY to general impression, it is no more difficult to make enlargements than contact prints. Enlarging offers many advantages besides big pictures; you can mask off unimportant parts of the negative and thus give emphasis to the better sections, and also perform all sorts of dodging operations. Many books have been written on the subject, but the fundamentals can be explained in a short article.

An "enlarger" is nothing more than a camera turned upside down, with light from a strong bulb made to shine through the negative, through a lens, and then onto a sheet of photographic paper of the desired size. Figure 1 represents the internal construction of 95% of the enlargers in use today. Some enlargers made for small negatives (the 35 millimeter size used in "candid" cameras) have one or more condensing lens placed between the bulb and the negative, to concentrate the light. The only real mechanical differences that will be found between various enlargers is that some are "auto focus" and others aren't. In the former type, a cam device moves the lens closer to the negative as the whole enlarger head is raised to make bigger prints; in the latter, this adjustment must be made by hand as the operator judges the sharpness of the image projected on the enlarger easel. The self-focusing type of course is more convenient, but then it costs more.

Most present day enlargers are of vertical construction, the lamp housing, with its attached negative holder and lens, being mounted on a heavy pipe or other standard. However, horizontal arrangements work just as well and some people prefer them. Their bad feature is the large amount of table space they occupy. The accompanying pictures show representative enlargers of popular styles.

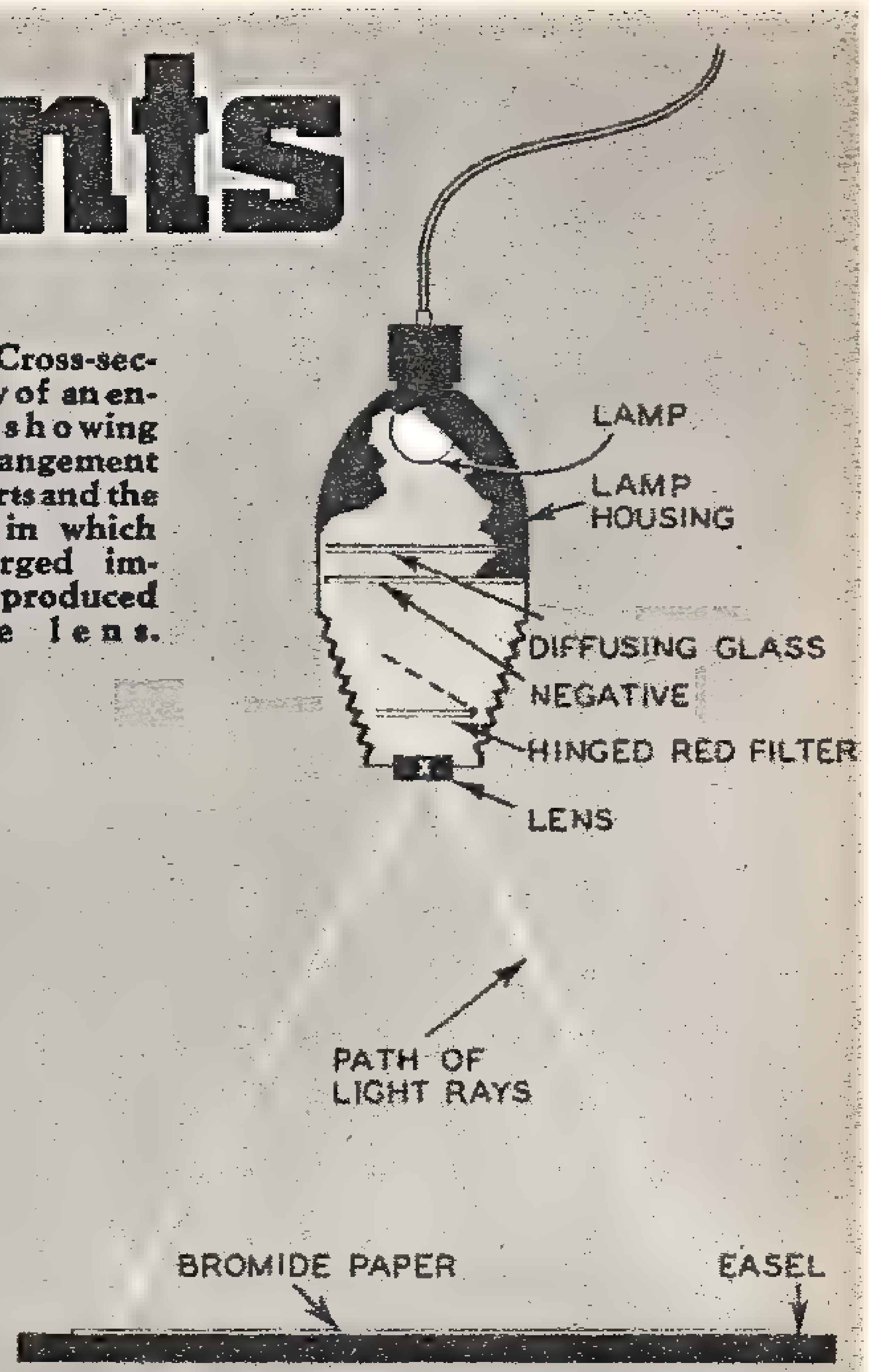
The dark room set-up for enlarging is very much like the one shown on page 108 of the December, 1937 issue of MODERN MECHANIX, modified as in Figure 2. As most amateurs rarely make prints larger than 8x10 inches, three trays of this size should be used. The first contains developer, the second the acetic acid shortstop bath (1½ ounces of acetic acid and cold water to make a quart), and the third the regular hypo fixing bath. The tank in the back is filled with water for washing the print tongs. The safelight is fitted with an OA (bright yellow) filter as recommended in the December article.

The most successful and widely used paper developer undoubtedly is "D-72," which is

Enlargements

available in prepared dry form, requiring only mixing with water. The "stock solution" is diluted 1:4 for enlarging paper, so a single can will last quite a while. An 8x10 tray will require at least a quart of solution; so measure out 6¼ ounces of stock solution and add cold water (70 degrees is the ideal temperature) to make 32 ounces. It is not advisable or economical to save this stuff after use. If it looks brownish, throw it away and mix a fresh bottle-full. The chemicals are cheaper than wasted prints and wasted time. By the way, don't fail to filter the solution before use.

Cleanliness and absolute freedom from dust in the dark room are the real secrets of enlarging success. One writer says that almost surgical cleanliness is necessary, and he isn't exaggerating much. A tiny speck of dust or lint on the negative looks like a baseball on the print with even medium size blow-ups. Clean the negative holder glasses (if a glass sandwich is used) by breathing gently on them and wiping again very gently, with a soft cloth. If you rub too hard you will electrify the glass and make it attract infinitesimal dust



Fix. 1: Cross-section view of an enlarger, showing the arrangement of the parts and the manner in which an enlarged image is produced by the lens.

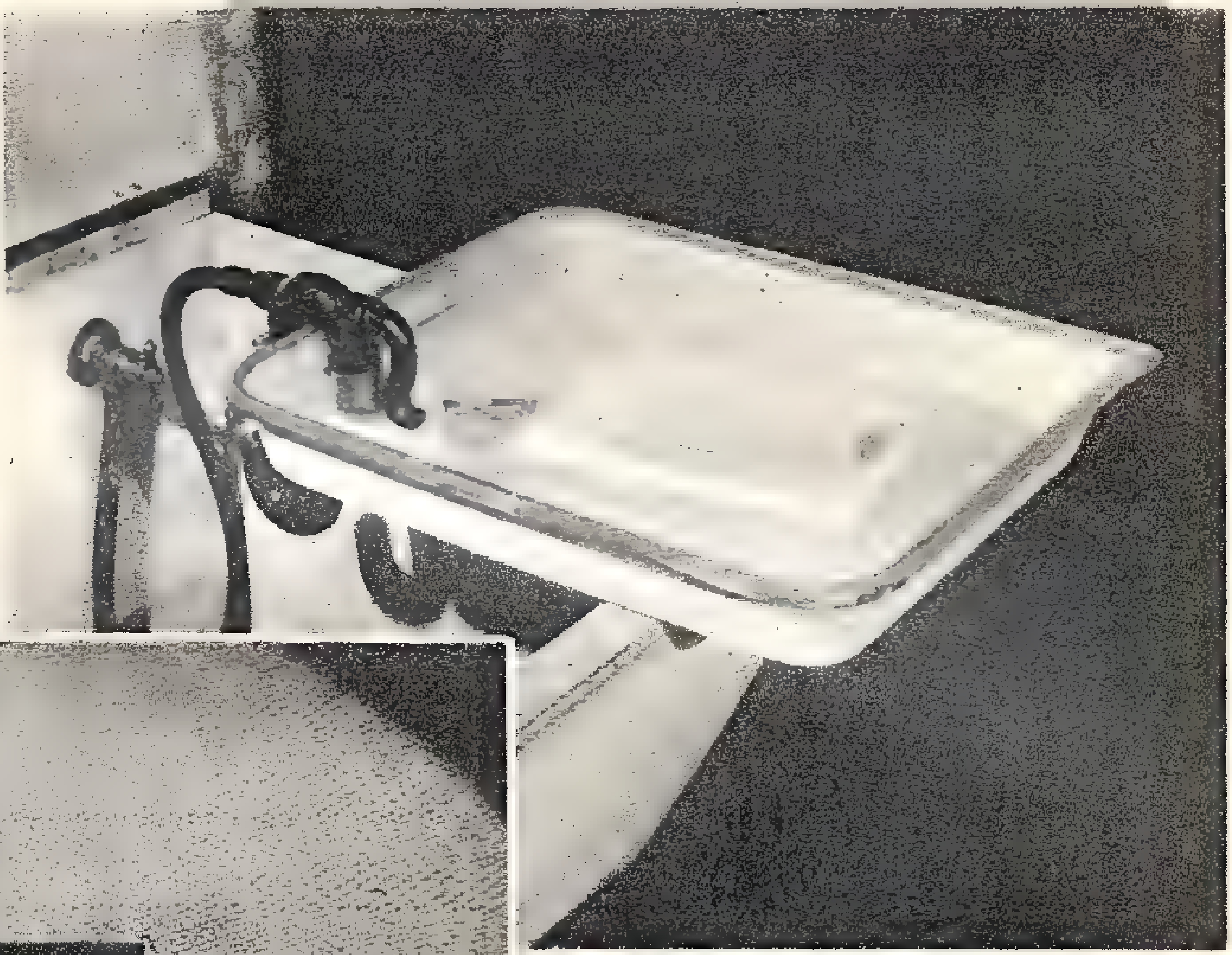


Fig. 3, above: A simple siphon attachment converts an ordinary tray into a very effective print washer. The tray is placed on the edge of a washtub or sink.

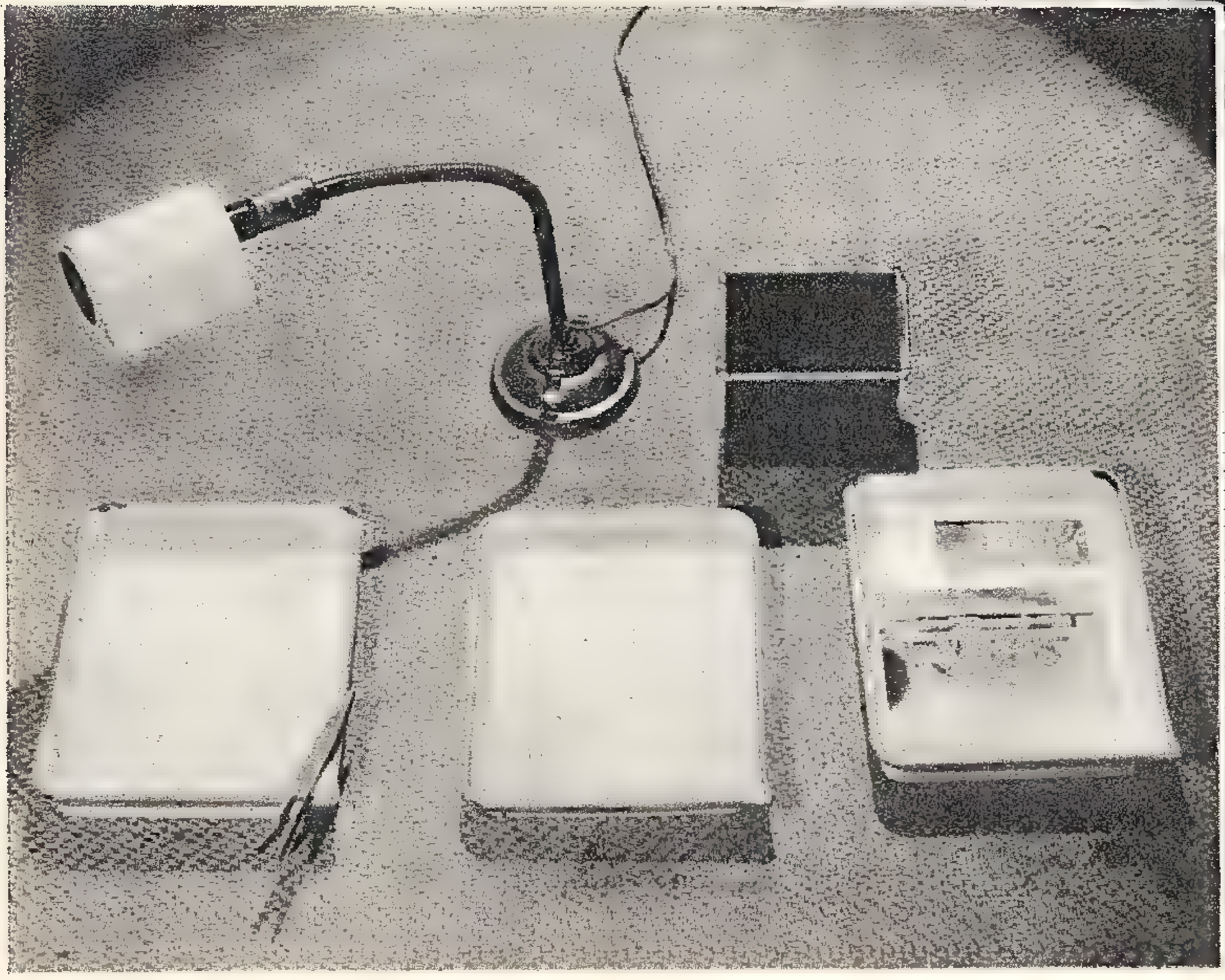


Fig. 2, left: Chemical set-up for making enlargements. Left tray, developer; center tray, acetic "short-stop" bath; right tray, hypo. Tank in back is for rinsing print tongs after prints have been dropped in the hypo. Safelight is fitted with "OA" yellow filter.

Above: A small circle of cardboard, attached to a piece of stiff wire, makes a good "dodging" tool. This is very useful in preventing overexposure of dark parts of the print, and for local control in general. The stunt requires practice, but once mastered, it will save many otherwise unacceptable pictures. Right: A popular low-priced enlarger of the horizontal type, which can be folded up and kept in a drawer when not in use. Prints up to 8x10 inches in size can be made with it. Note how the paper is kept flat during exposure by two spring bands.

particles that you can't even see! Place the negative emulsion (dull) side toward the easel, and you are ready to start.

Practically all enlarging paper is known as "bromide" paper, as distinguished from the "chloride" type used for contact printing. It is much "faster" than the latter, this speed being necessary because the light projected through the enlarger is more diffused than the direct, close light in a contact box such as described on page 109, December, 1937 issue.

Dozens of different finishes are available. The most popular paper is "semi-matte," which has a soft, smooth appearance. Most camera fans develop a liking for one finish or another and stick to it; this is entirely a matter of experimenting. As for size, it is a good idea to use small sheets for the first trials; 5x7 is quite respectable and also quite inexpensive. Don't invest in bigger sheets until you have mastered the operations and are sure that your negatives are good enough for that much enlargement.

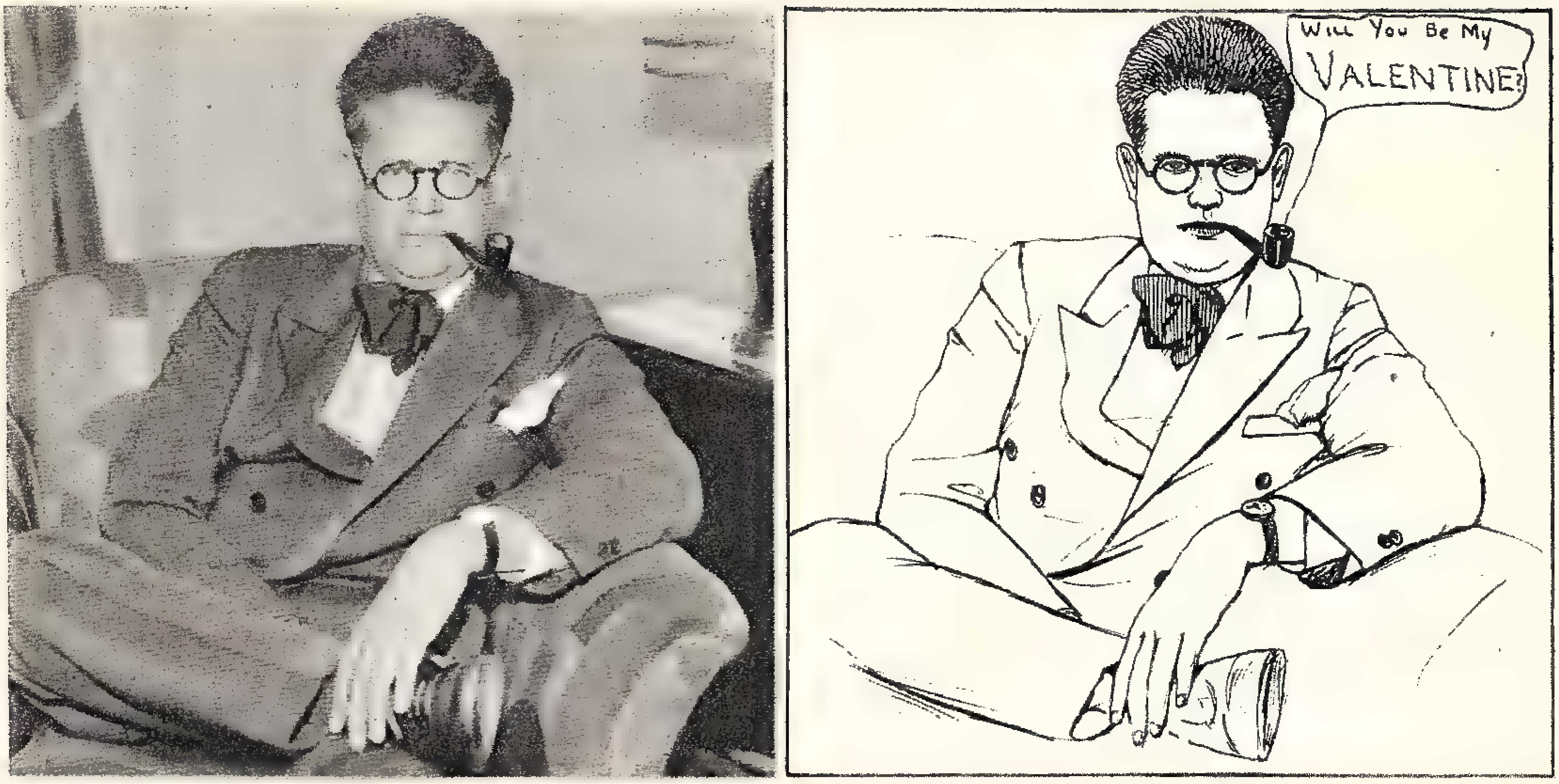
An easel for keeping the paper flat during exposure is quite necessary. Get one with adjustable bands and margins, and large enough to take 11x14 paper. It will thus hold anything up to and including 8x10 very comfortably.

Adjust the height of the enlarger head and the position of the lens so that a clear, sharp image is projected on the white surface of the easel. Keep the bromide paper well covered so that it will not be fogged by stray white light from the lamp housing. For the beginner a small device known as a focusing magnifier is a big help. This is placed on the easel and throws a magnified section of the image to the operator's eye. If the enlarger is auto-focus, this of course is not necessary.

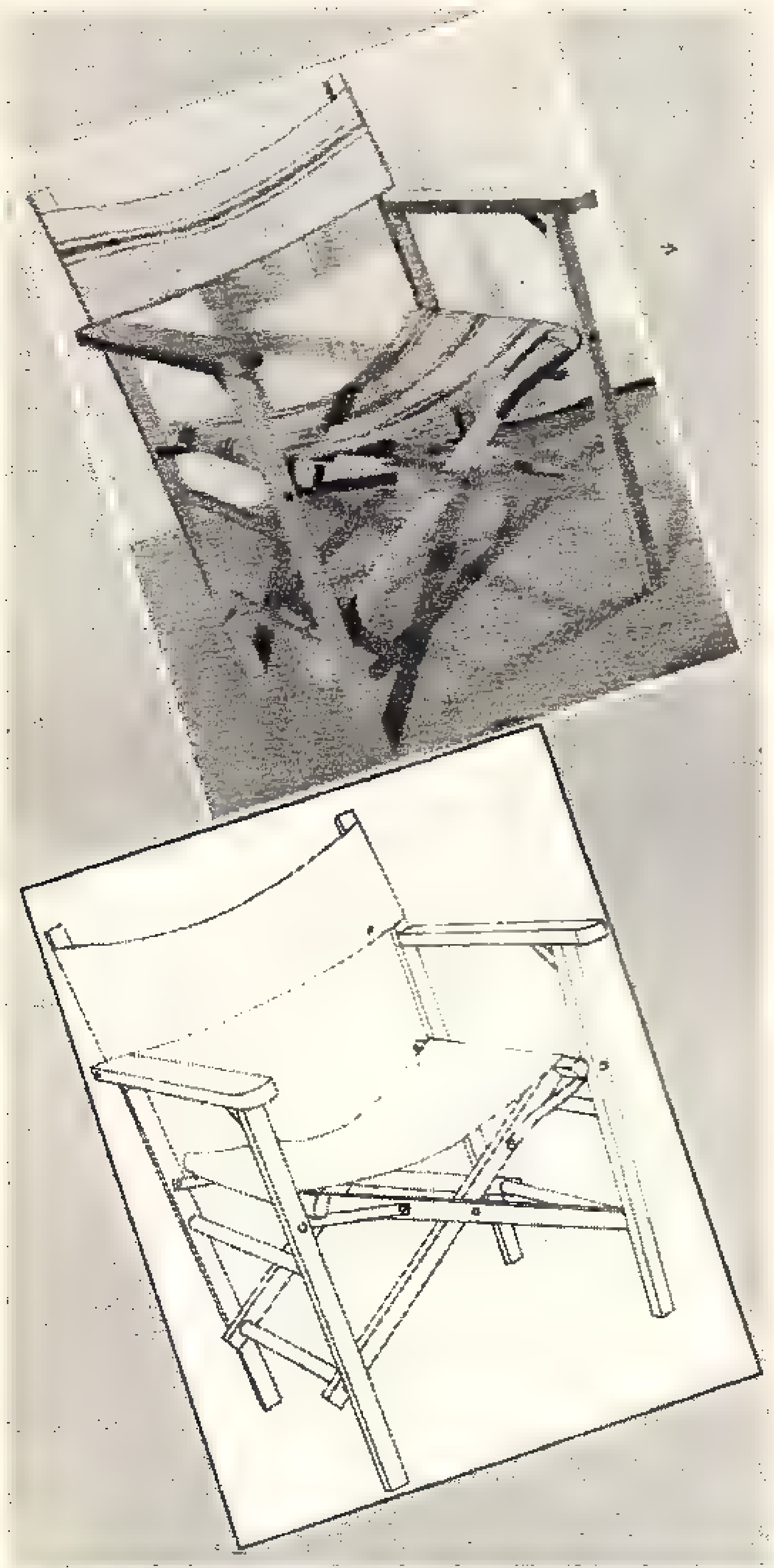
There are contrast, normal and medium types of paper. The exact one to suit each particular negative is a matter of judgment growing out of experience. Slightly thin, flat negatives require contrast paper; normal, contrasty negatives take normal paper. A peculiar diffusing effect takes place in enlarging, and negatives that take normal paper for contact prints may need contrast paper for enlargements. As a matter of fact, contrasty negatives are not desirable for enlarging purposes. In general, better results are obtained with slightly thin, not-too-contrasty ones. For this reason contrasty film developers like the MQ, originally recommended in the November issue, should be

[*Continued on page* 124]

TRICK Drawings From PHOTOS


Will You Be My VALENTINE?

These "before and after" pictures illustrate the possibilities of the simple and easily used silver-print process. The lettering in the "balloon (above) was drawn in by hand.



MANY novel effects can be obtained by means of a simple process of converting ordinary photographic prints into black-and-white or colored line drawings. For engineering and other technical purposes, unnecessary or unimportant parts of machinery can be eliminated from a picture and the main structure thus given increased emphasis. For purposes of general illustration—serious or humorous—the faces or figures of people can be exaggerated or caricatured, double pictures built up, extra features inserted, etc. Comparatively little drawing ability is required, as the original print serves as a guide.

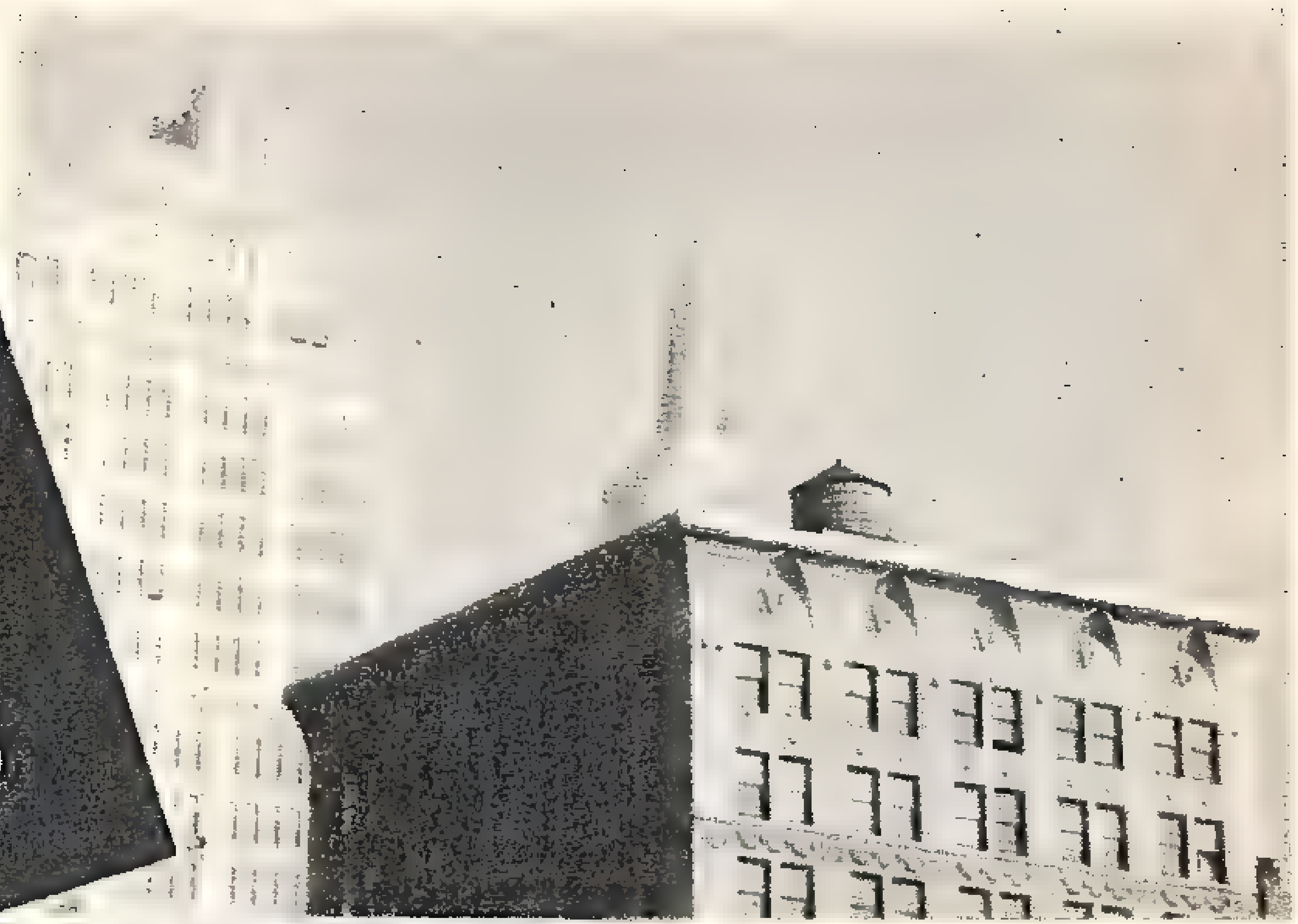
The accompanying illustrations show two typical trick drawings made from photographs. The beach chair was selected as a simple exercise because its lines are straight and were readily drawn in with T square and triangles. If this drawing were required for a construction project, the actual dimensions could be ruled in very easily, and the finished illustration would be a complete and easily followed perspective.

The second pictures show how an otherwise formal and dignified portrait can be turned into a comic Valentine card, with a "balloon" coming out of the pipe. The possibilities in this direction are practically limitless.

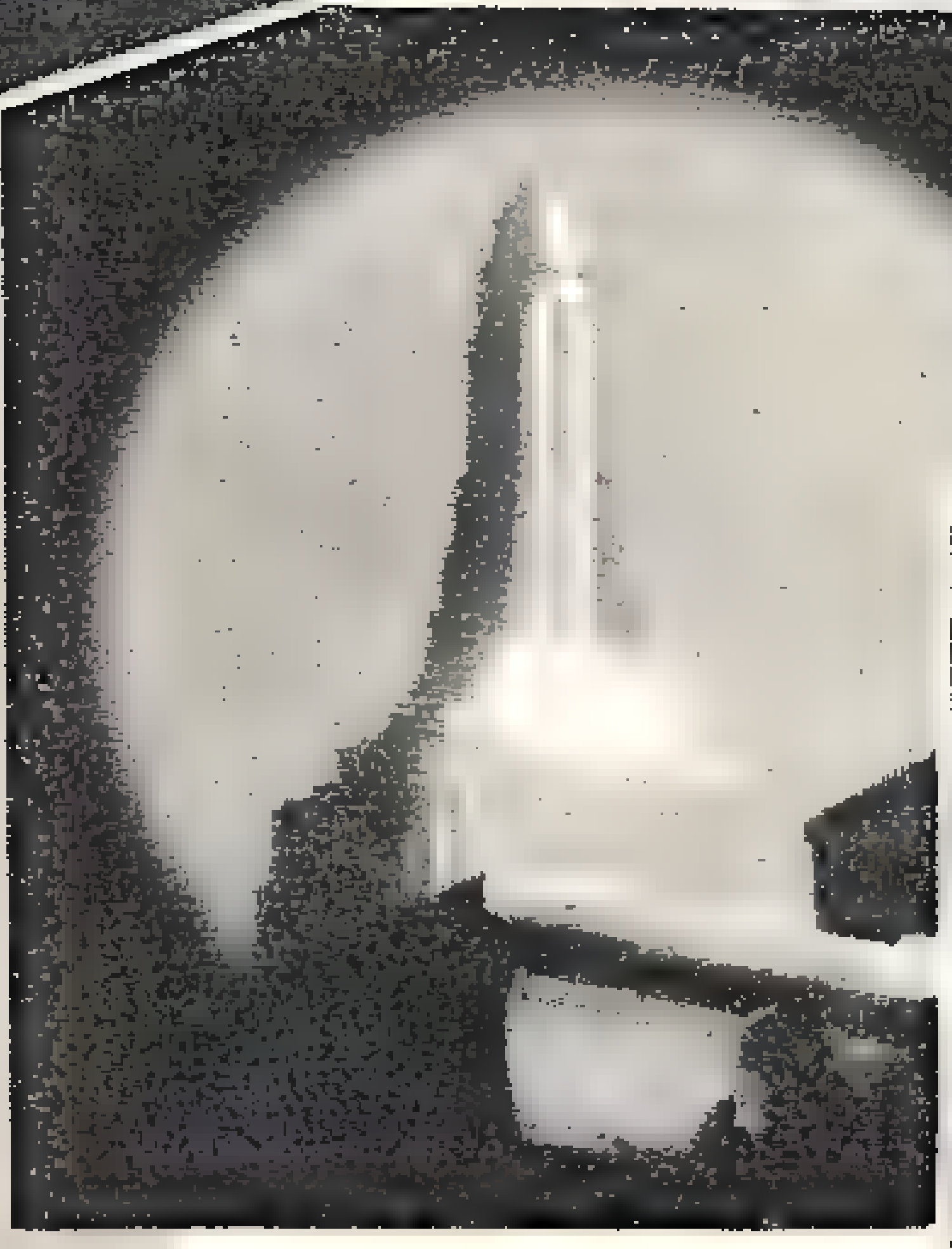
[*Continued on page* 134]

TRICKS WITH LENSES

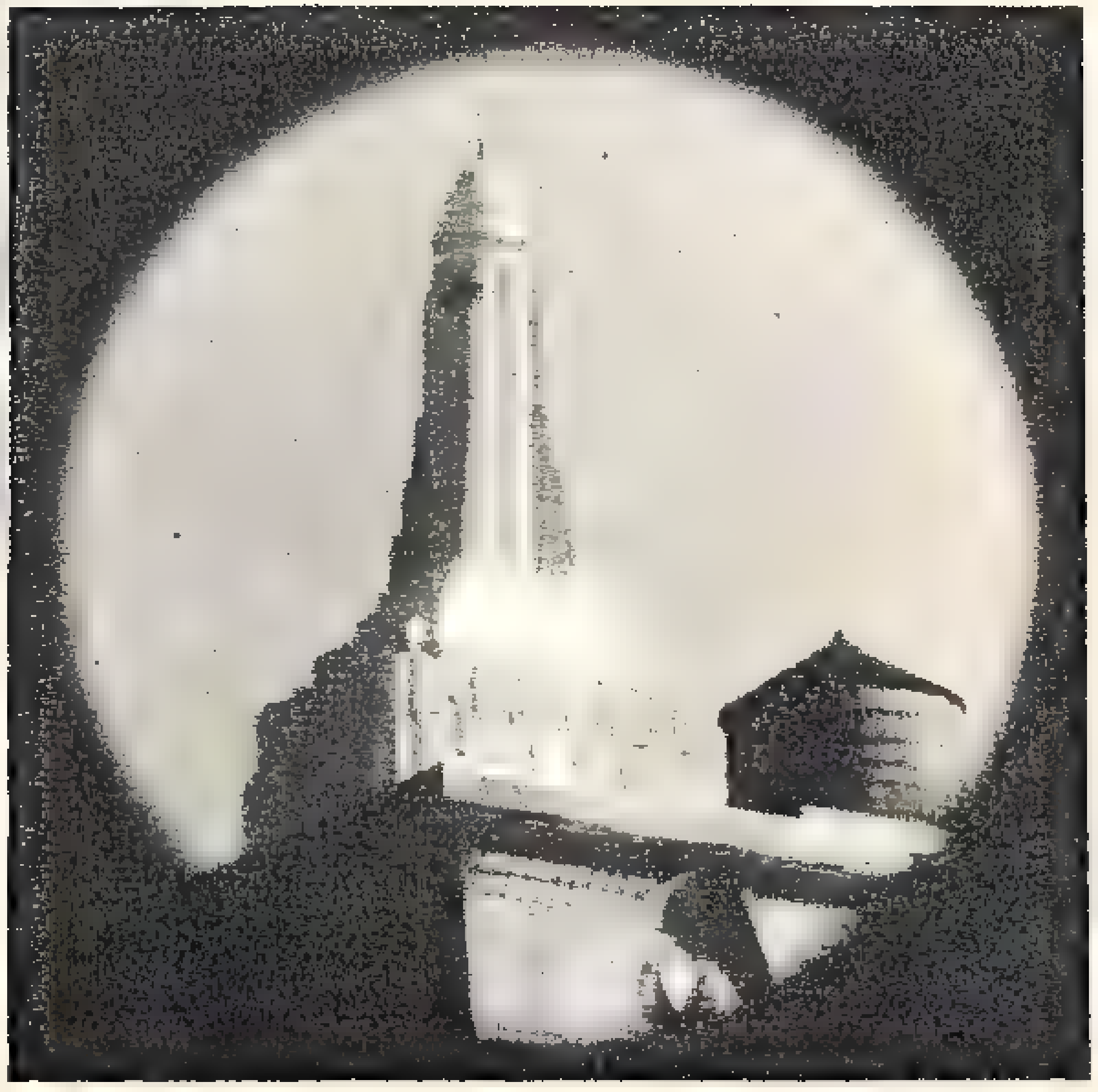
by A. J. Lockrey



Above — The Empire State building tower taken with an ordinary camera on a hazy day.



Right — The same scene when taken with 3-power binoculars and a K2 filter placed before camera lens.



Right — The best photo of the three, taken by binding a 10-power navy telescope and a K2 filter over the camera lens with tape.

IT IS the purpose of this article to dispel a little of the awe and trepidation with which the average amateur approaches the subject of camera lenses and auxiliary lenses, and to show how most of the effects obtained with extremely expensive equipment can be duplicated satisfactorily with ordinary everyday lenses of various types.

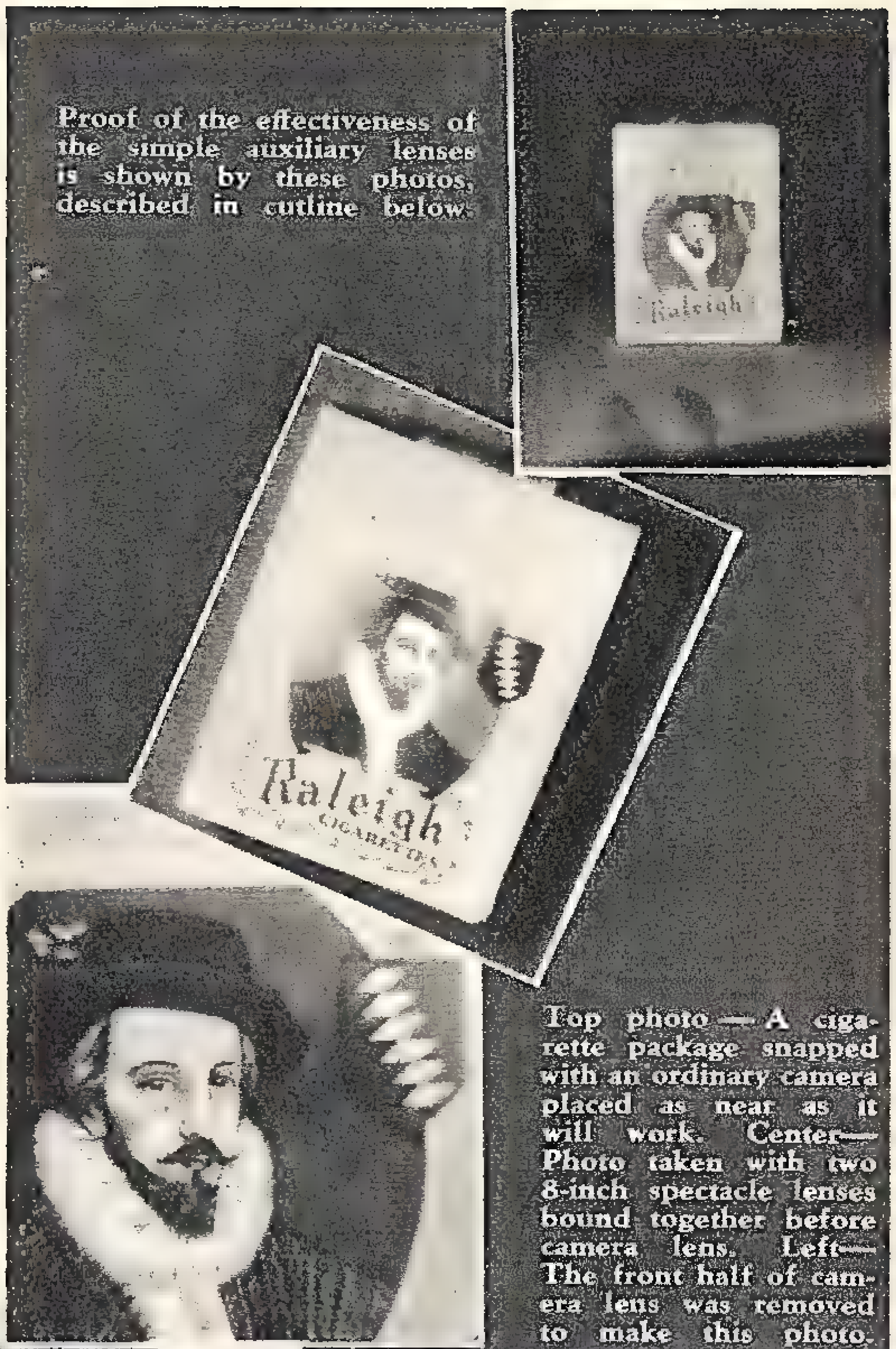
There are very good reasons for the high cost of the regulation auxiliary lenses, but 90% of this goes for extreme speed, accuracy and ultra-correction which the average amateur does not need in order to achieve the effects he has in mind. Portrait work particularly, and its second cousin, table-top photography, certainly do not require speed, extreme accuracy or correction, for the reason that portraits are preferably taken with diffusers, or are diffused slightly in the printing or enlarging process, while table-top work is usually of such a nature that aberrations go unnoticed.

The commonest desire of the camera addict is to be able to work closer to the camera, for portrait, table-top or other purposes, and this requires the simplest type of auxiliary lens. Amazing as it may sound, practically any type of lens under the sun may be used for a portrait-lens, and mounted in practically any manner conceivable, at any distance from the camera, direction booklets to the contrary notwithstanding. This may sound like a very broad statement, but the photos submitted herewith prove it.

In the first series (on the opposite page) is a shot of a package of cigarettes made with a small reflex camera, with the ordinary lens as close as it will normally work. In the successive shots, the object approaches closer and closer until we have nothing but a portrait of Sir Walter, half-tone dots and all, at a distance of *two inches* from the camera.

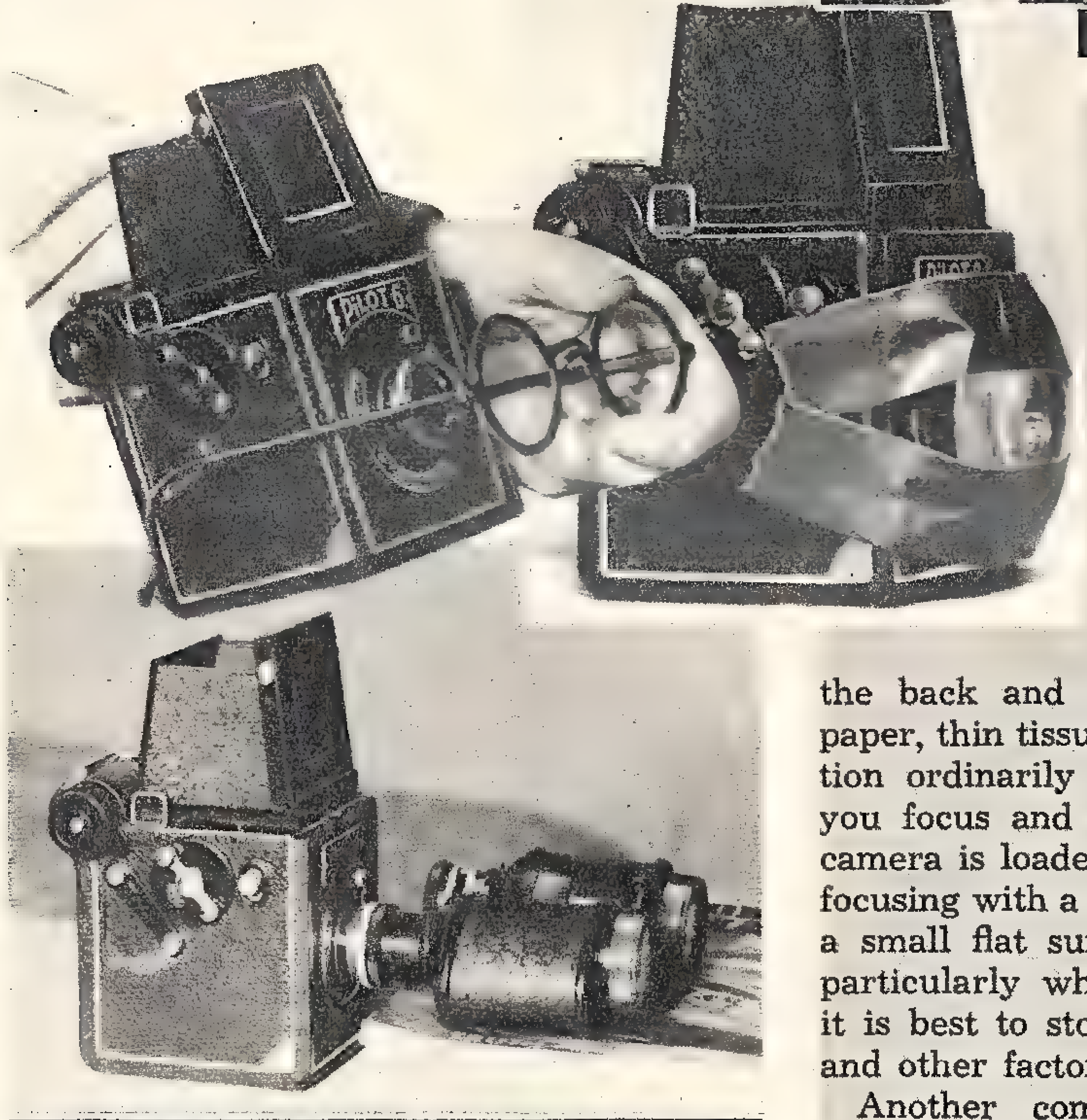
The most convenient type of lens to use for this purpose is an ordinary ten-cent store spectacle lens. These are marked with various numbers, from 8 to about 30, which refer to the focal length. From 20 to 30 is a good length for portraits, while lengths down to 8 inches or even less can be used for closer work. Lacking this type of lens, any ordinary hand magnifying-glass lens will do. These are practically all 8-inch lenses or thereabouts, and are possibly better for this use than spectacle lenses, even if not as convenient, for the reason that only the center portion of the lens is being used, which cuts out most of the aberration, although, as stated above, it is hardly noticeable.

For working at shorter distances than the lenses on hand will permit, it is only necessary to "double up," i. e., hang still another lens in front of the one you are using, or two or three for that matter. If conditions permit, the lens may be merely held up against the camera-lens by hand. If a more permanent rigging is desired, the lens may be stuck to the camera with Scotch tape, as shown in one of the photos, or a regular lens-ring may be made, of the proper dimensions for ready removal and attachment, by winding kraft-paper adhesive tape around the camera lens. Wrap the first layer with the gum side out, stick it to itself, and then wrap as many layers as needed on top of that, then bind the auxiliary lens to that ring with more tape. When this assembly dries, it will be as convenient to use as a regular portrait attachment. The supplementary lens can be mounted in direct contact with the camera-lens, or any distance away from it. The field automatically moves away from the camera the same distance, but conditions are not altered otherwise, for all practical considerations.


Proof of the effectiveness of the simple auxiliary lenses is shown by these photos, described in cutline below.

Top photo — A cigarette package snapped with an ordinary camera placed as near as it will work. Center—Photo taken with two 8-inch spectacle lenses bound together before camera lens. Left—The front half of camera lens was removed to make this photo.

There is only one requirement and one caution in using hay-wire lens assemblies such as this — you must have a camera with ground-glass focusing facilities, either back or reflex such as the one pictured, as depth of focus at such short distances is extremely shallow; a quarter of an inch may throw your picture out of focus, the latitude varying with the lens stop used and the distance from the camera. If your camera is not a reflex, you can calibrate it by removing the back and attaching a piece of waxed paper, thin tissue or ground glass in the position ordinarily occupied by the film, while you focus and measure. Then, when your camera is loaded with film, you can do your focusing with a ruler. If anything other than a small flat surface is being photographed, particularly when working under two feet, it is best to stop down as far as your light and other factors will allow.



Binoculars placed on a book before the camera, Grandma's spectacles held in place by hand, and an ordinary 20 to 30 focal length lens taped over the regular camera lens, as shown in above photos, serve well as auxiliary lenses.

Another common method of "working close," suitable only for certain types of cameras, is to remove the front half of the

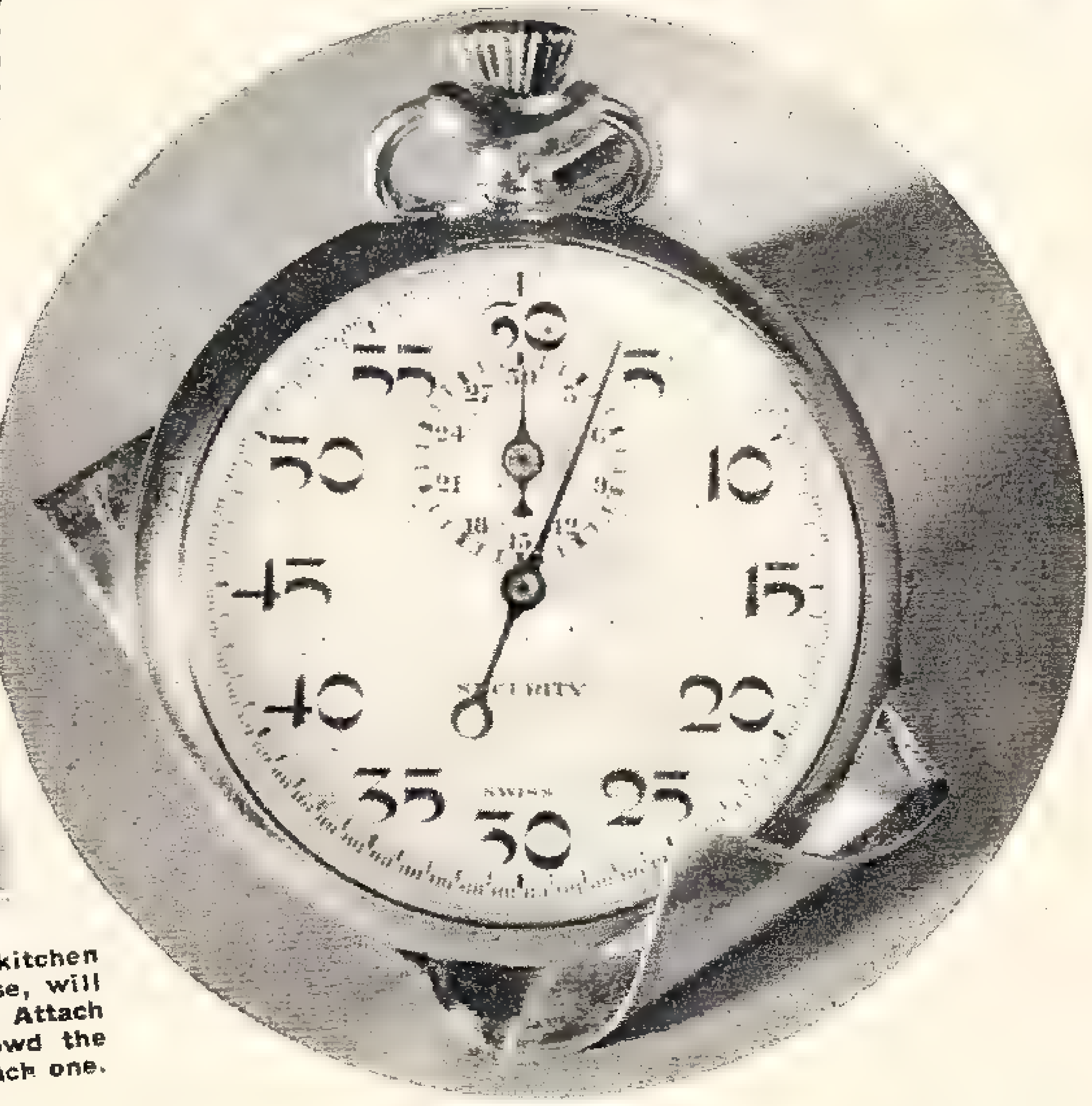
[*Continued on page* 128]

PHOTO

MIRROR REFLECTS LIGHT OF DARKROOM LAMP. With but one safelight in the darkroom, you can avoid carrying it about by using a small mirror mounted on a wood block, as shown above. This will reflect a spot of red light to any part of the darkroom. The angle at which to hold the mirror is determined entirely by experiment.

VEST POCKET DARKROOM LAMP. A red safelight that you can carry in your pocket is an advantage when you wish to change films while away from your own darkroom. Use a pen-light of the type shown above (right), dipping the concentrated-filament bulb in red lamp coloring, obtainable at any neighborhood electrical supply store.

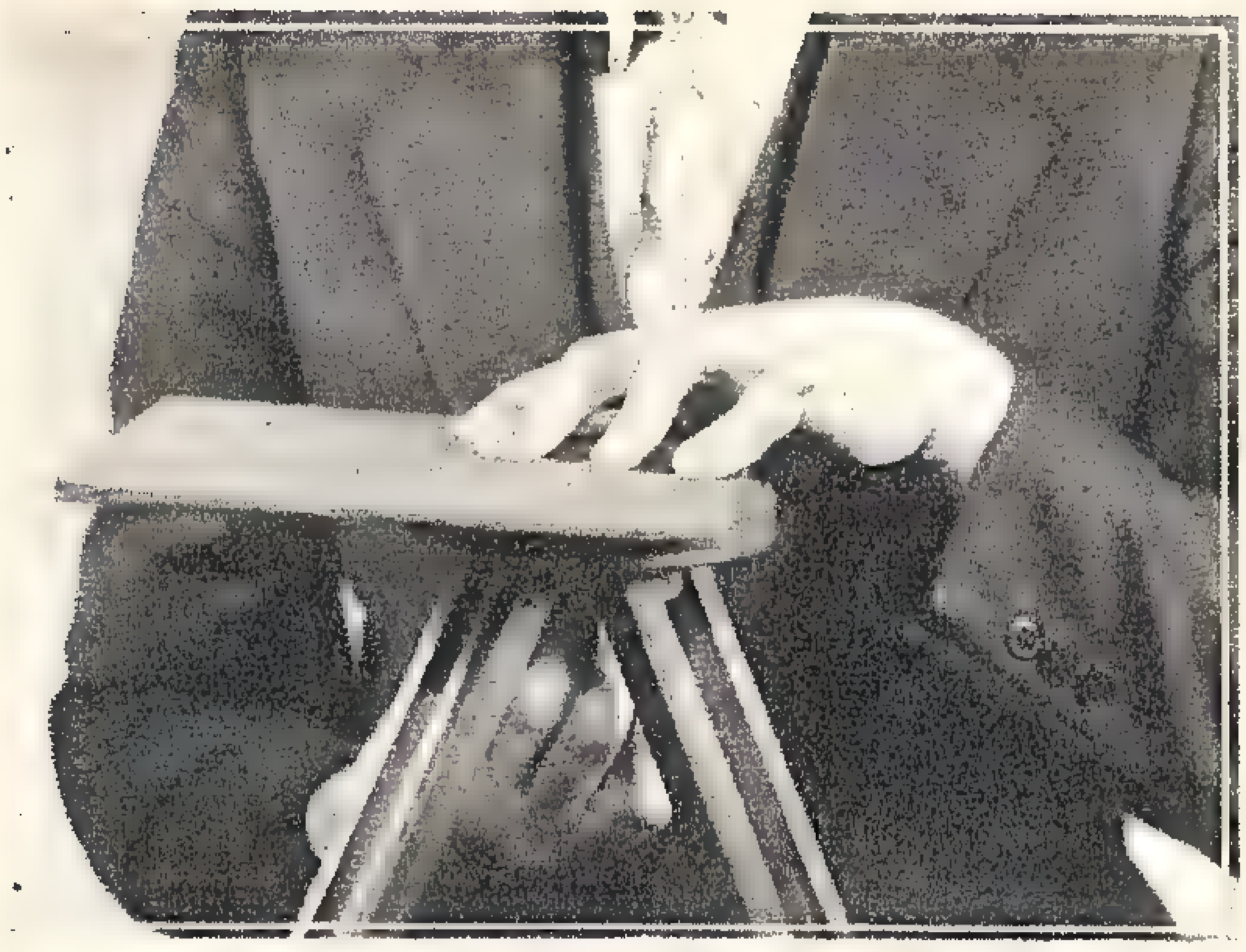
HANGER FOR DRYING CUT OR ROLL FILM. An ordinary ten-cent kitchen towel holder, which fits conveniently against the wall when not in use, will hold a dozen or so films while they are drying, as shown above. Attach each film to an arm of the holder with a push-pin, but do not crowd the films as they will dry more quickly if air can circulate freely around each one.



INDICATOR FOR DARKROOM WATCH. Point one end of a small strip of tin, bending the point over so it touches stop-watch dial (circle). Turn watch until the tin point rests over the number of seconds required for your enlarging job.

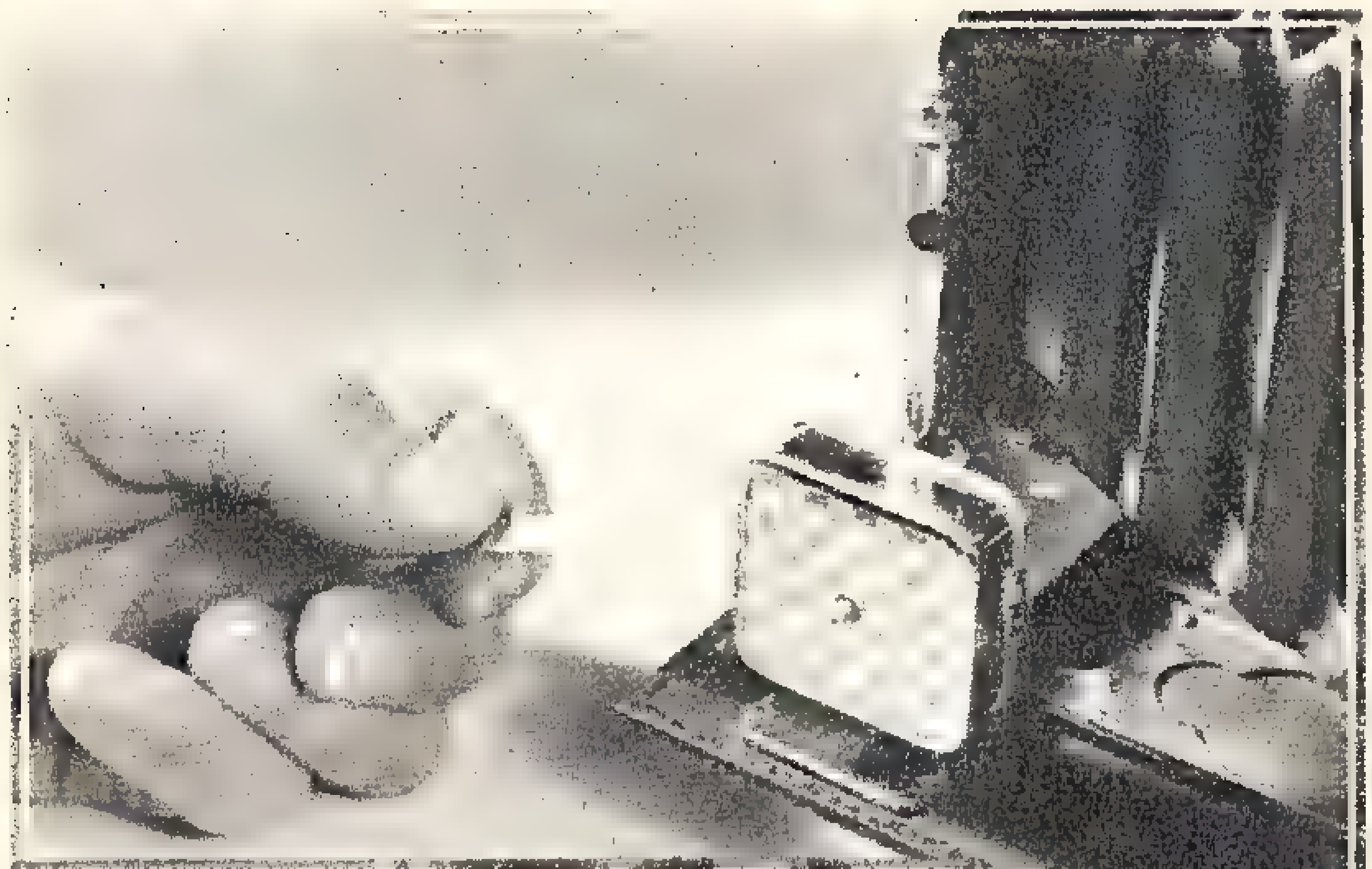
UNBREAKABLE LENS SHADE. Secure a five-cent rubber ball and cut an opening in one side for the lens and a larger opening on the other side. Blacken the inside completely with wallboard paint (below).

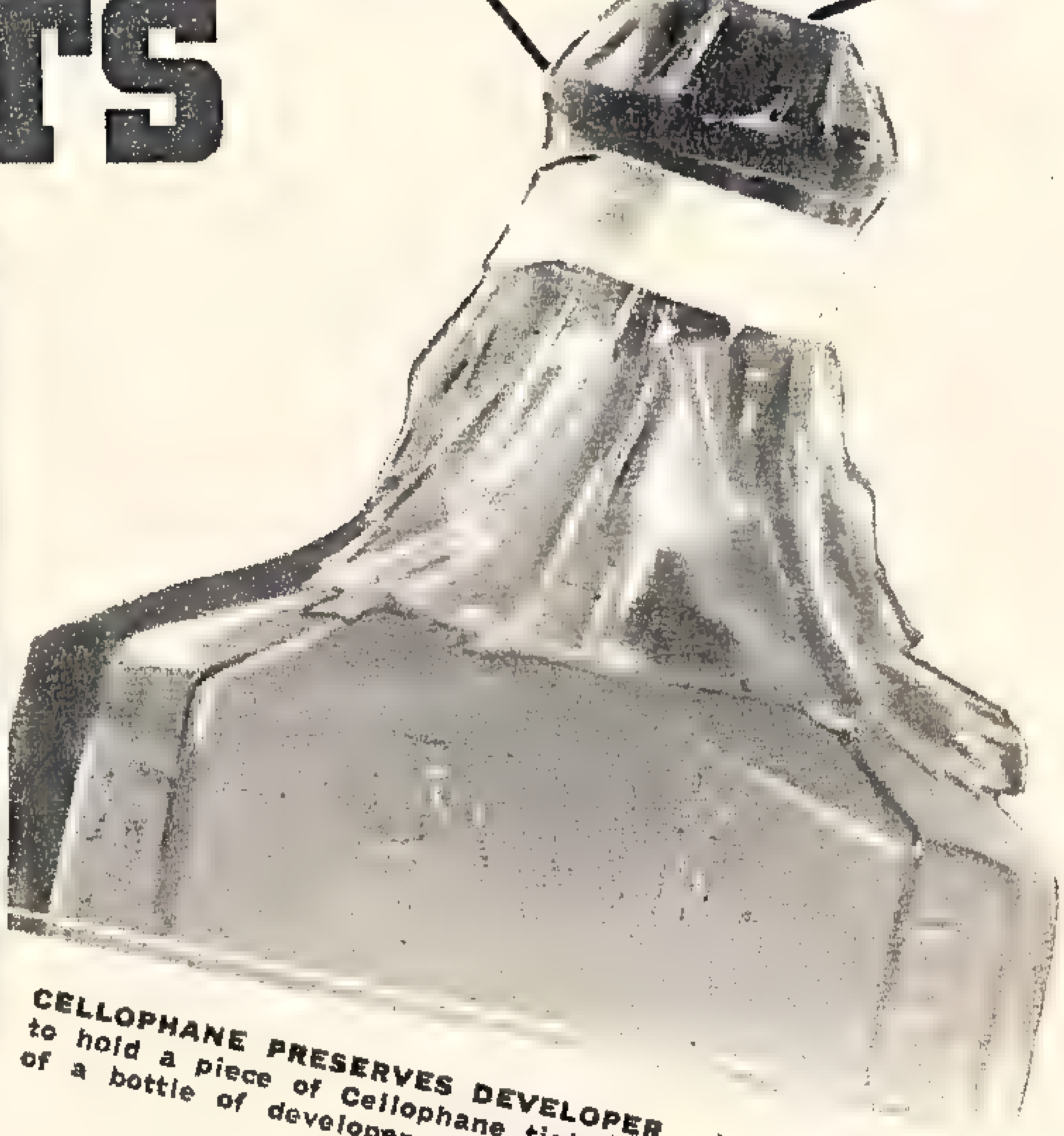
CARDBOARD STRIP KEEPS DEVELOPER TEMPERATURE EVEN. A piece of cardboard, placed under a tray of developer solution, will help to keep the developer temperature even by eliminating contact with table or bench (below).



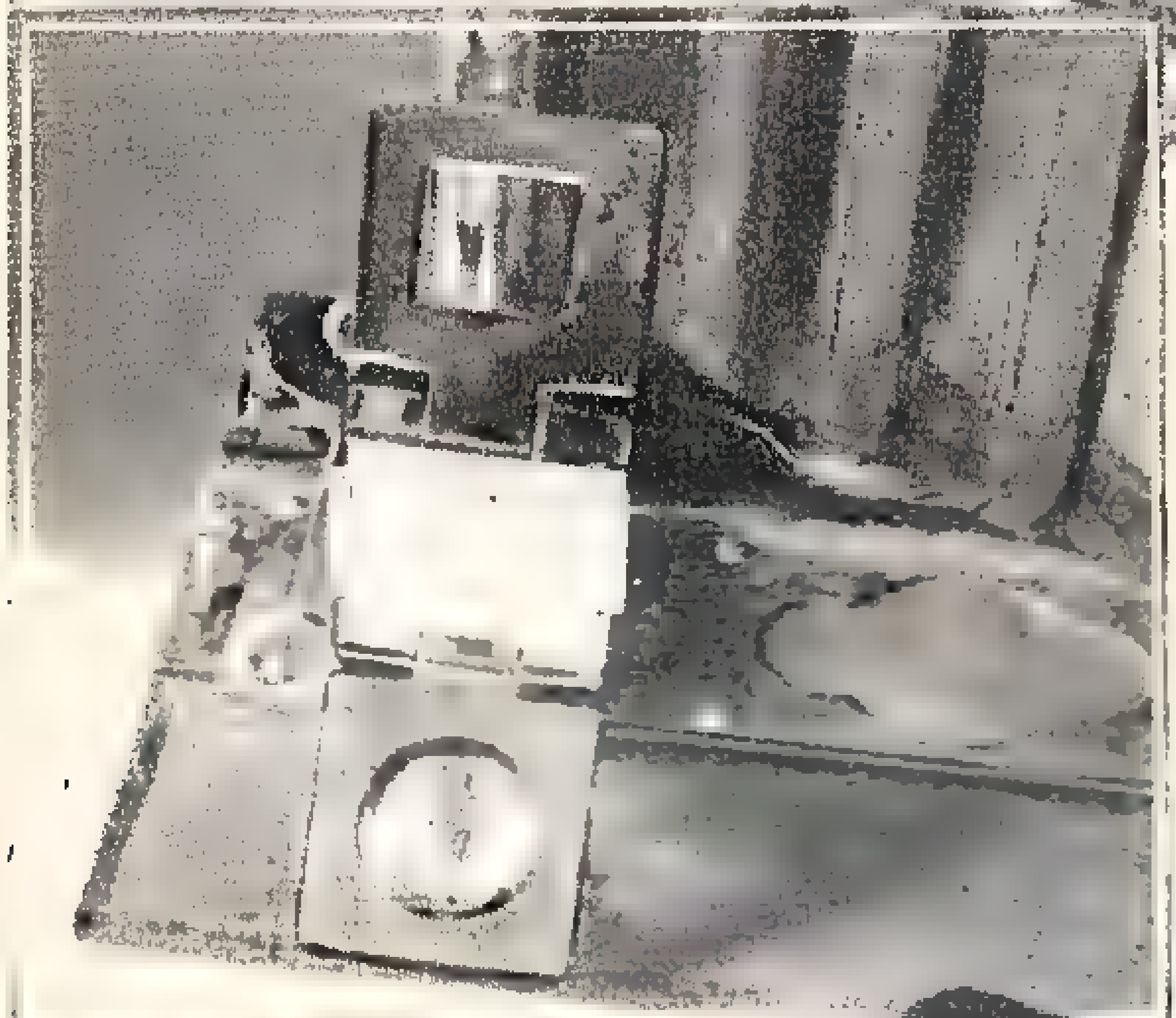
SHELF ATTACHMENT FOR TRIPOD. An oblong piece of one-quarter inch Prestwood, or similar material, attached to the top of a tripod (left), will provide a shelf at the back of the camera for holding ground glass, film pack, slides, and spare parts. Only one hole need be made in the small shelf, as shown.

SHORT CUTS



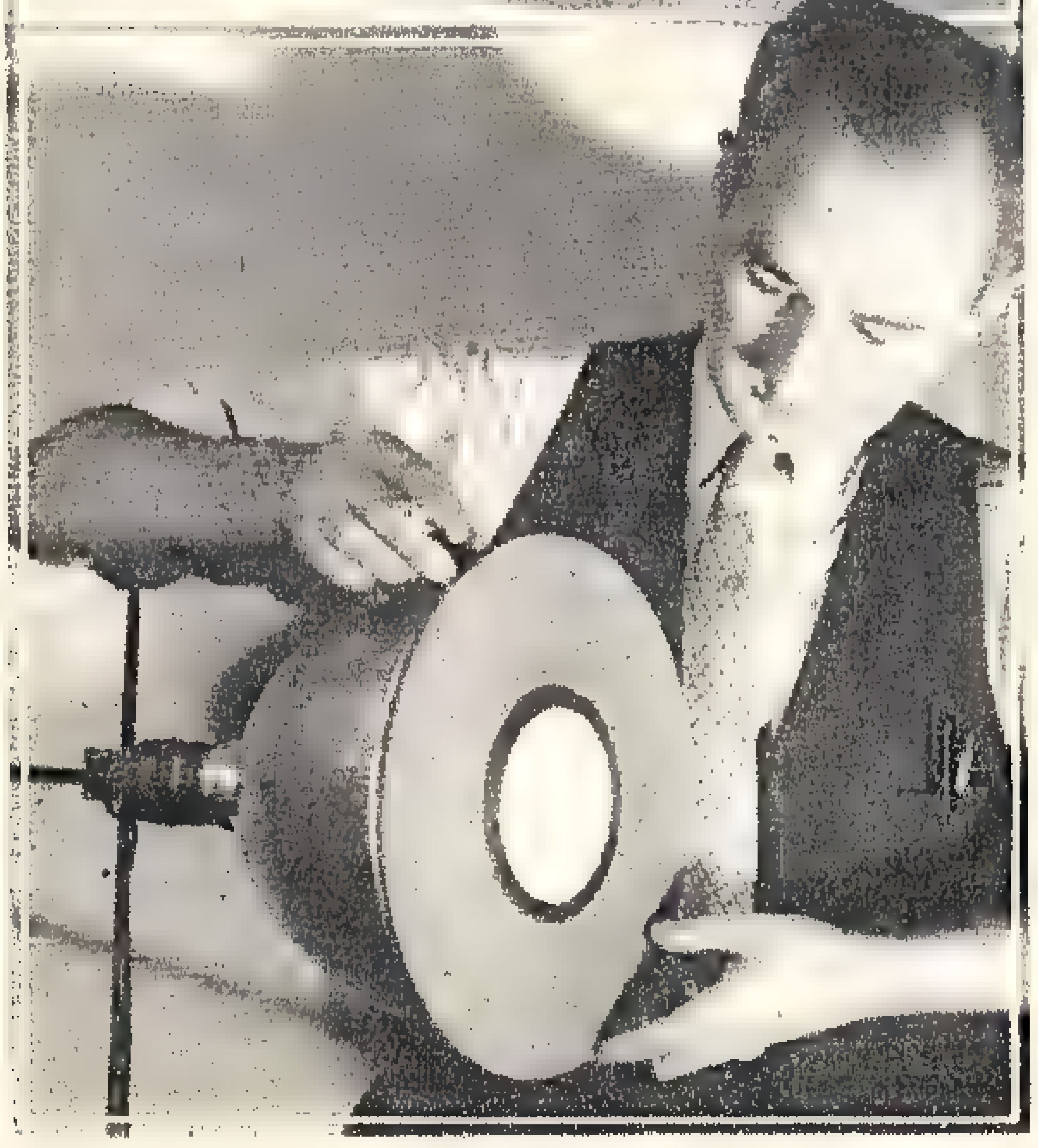


CELLOPHANE PRESERVES DEVELOPER. Use adhesive tape to hold a piece of Cellophane tightly around neck and cork of a bottle of developer to keep out air and dust (above).



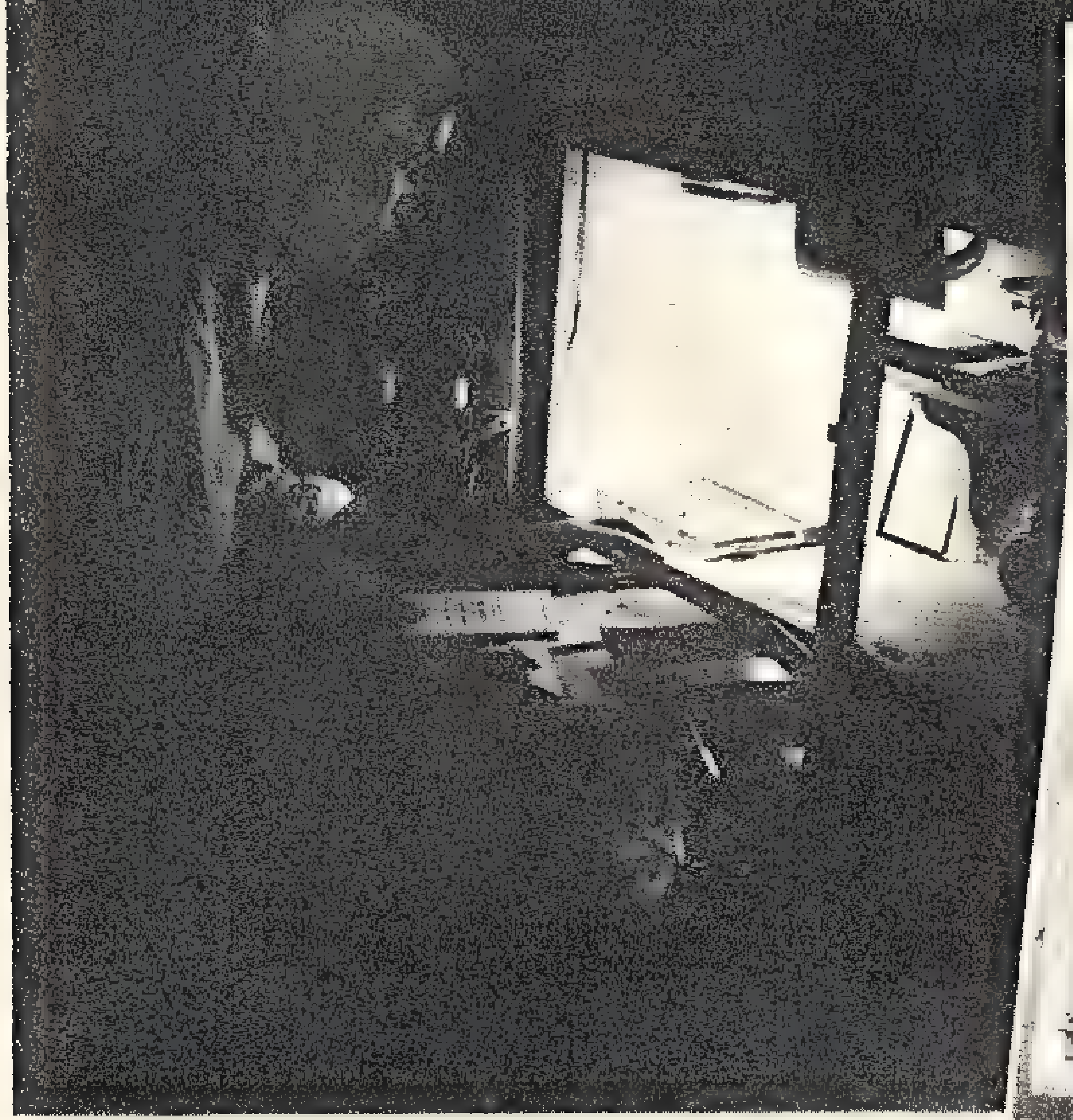
TAPE MEASURE AIDS IN FOCUSING. A spring-type tape measure (above, left) clipped to the front of a camera so that the case is on the same plane as the lens will enable you to take advantage of auxiliary lenses for copying and portrait work by providing method of measuring distance from the lens to the object being photographed.

MAGNIFIER AIDS IN READING DISTANCE GAUGE. A small magnifier attached to front of camera with metal clips shows the figures and pointer greatly enlarged, as shown in photograph at the left.

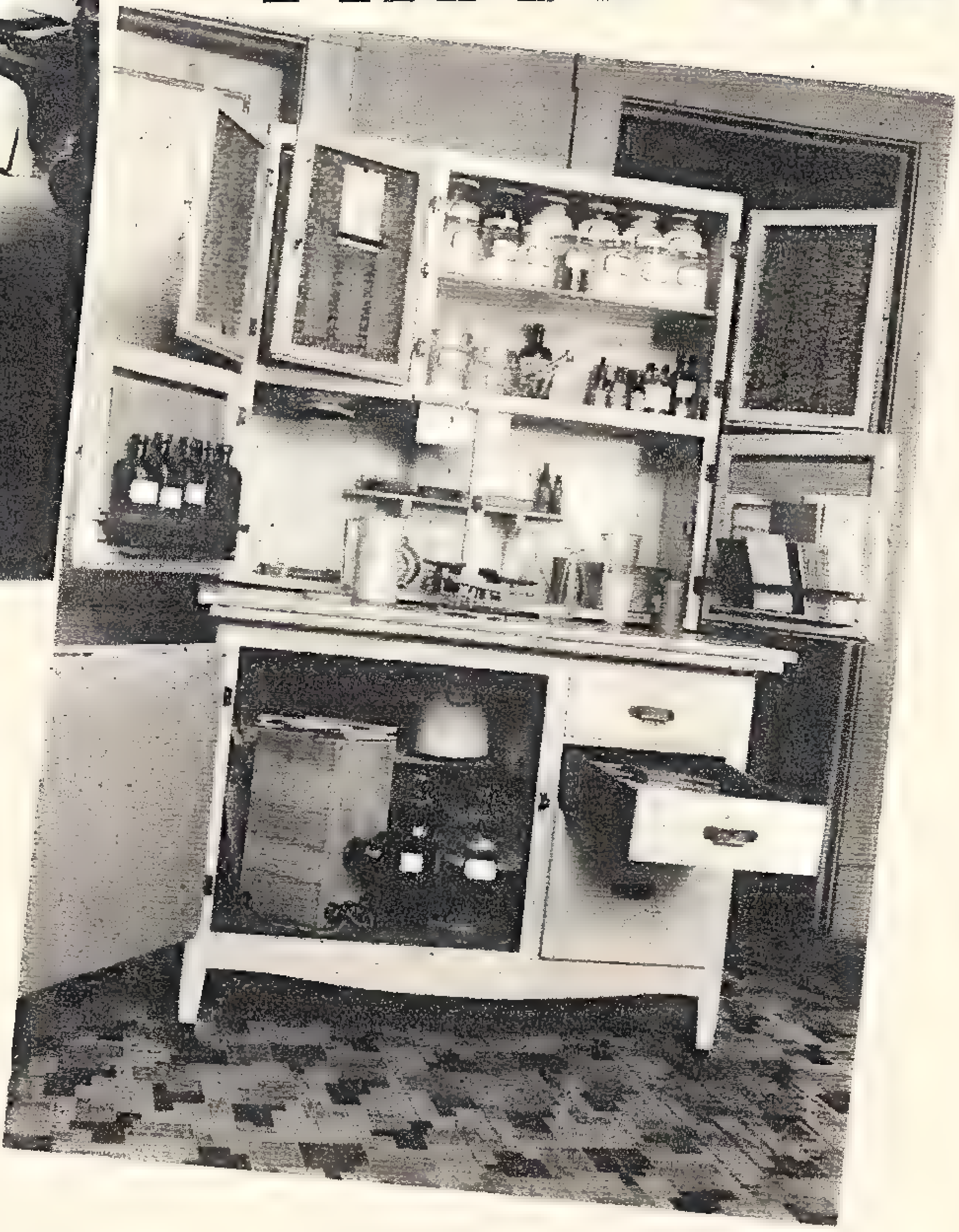


CONVERTING A FLOOD LAMP INTO A SPOTLIGHT. Cut a baffle from a piece of 1/4-inch Prestwood, placing bolts at the edges for hooking it over flange of flood lamp reflector. Cut a hole in center to accommodate a five-inch condensing lens and mount the latter, with convex side out, by means of Prestwood rings glued in place (left).

CLIP ATTACHES THERMOMETER TO TRAY. Waterproof a spring-type clothespin by dipping it in hot paraffine and use it to attach a thermometer in one corner of the developer tray, providing a means of checking temperature accurately.



KITCHEN CABINET BECOMES PHOTO LAB



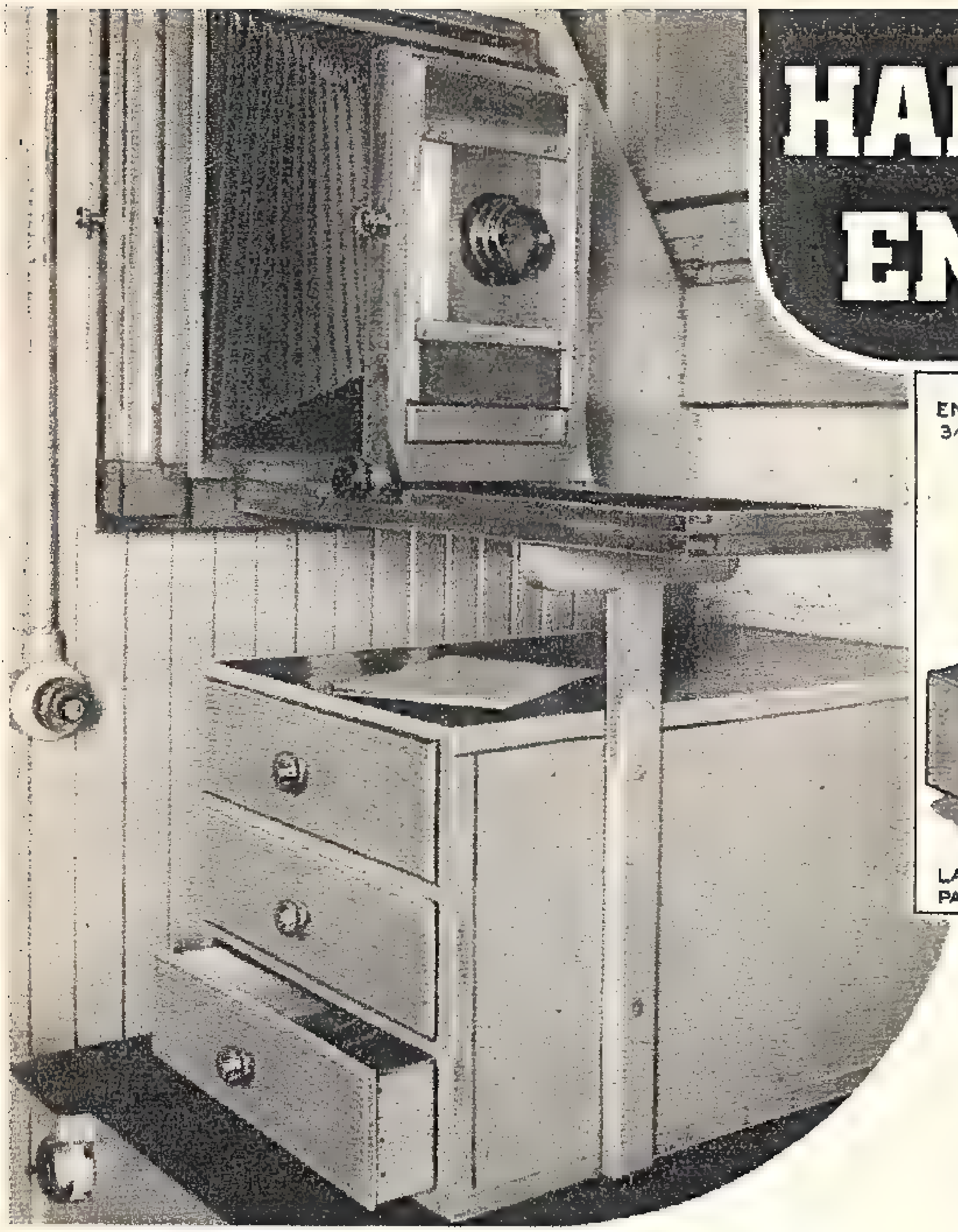
A second-hand kitchen cabinet (right) can easily be converted into a compact photographic laboratory, providing space for supplies of chemicals, scales, graduates, etc. The left-hand upper compartment can be made into an efficient enlarger, as described in the text below. Above—The enlarger, with lens removed, being used as a light source for making contact prints. A built-in safelight with colored glasses serves to illuminate working area.

A HANDY compact photographic laboratory can be arranged by the amateur from an ordinary kitchen cabinet. As most modern homes now have built-in cabinets, discarded movable types can be picked up second-hand for as little as $5.00. Placed in the garage, spare room, basement, or wherever the photographic work is usually carried on, such a cabinet provides adequate storage for materials and equipment as well as space for printing, developing and mixing solutions.

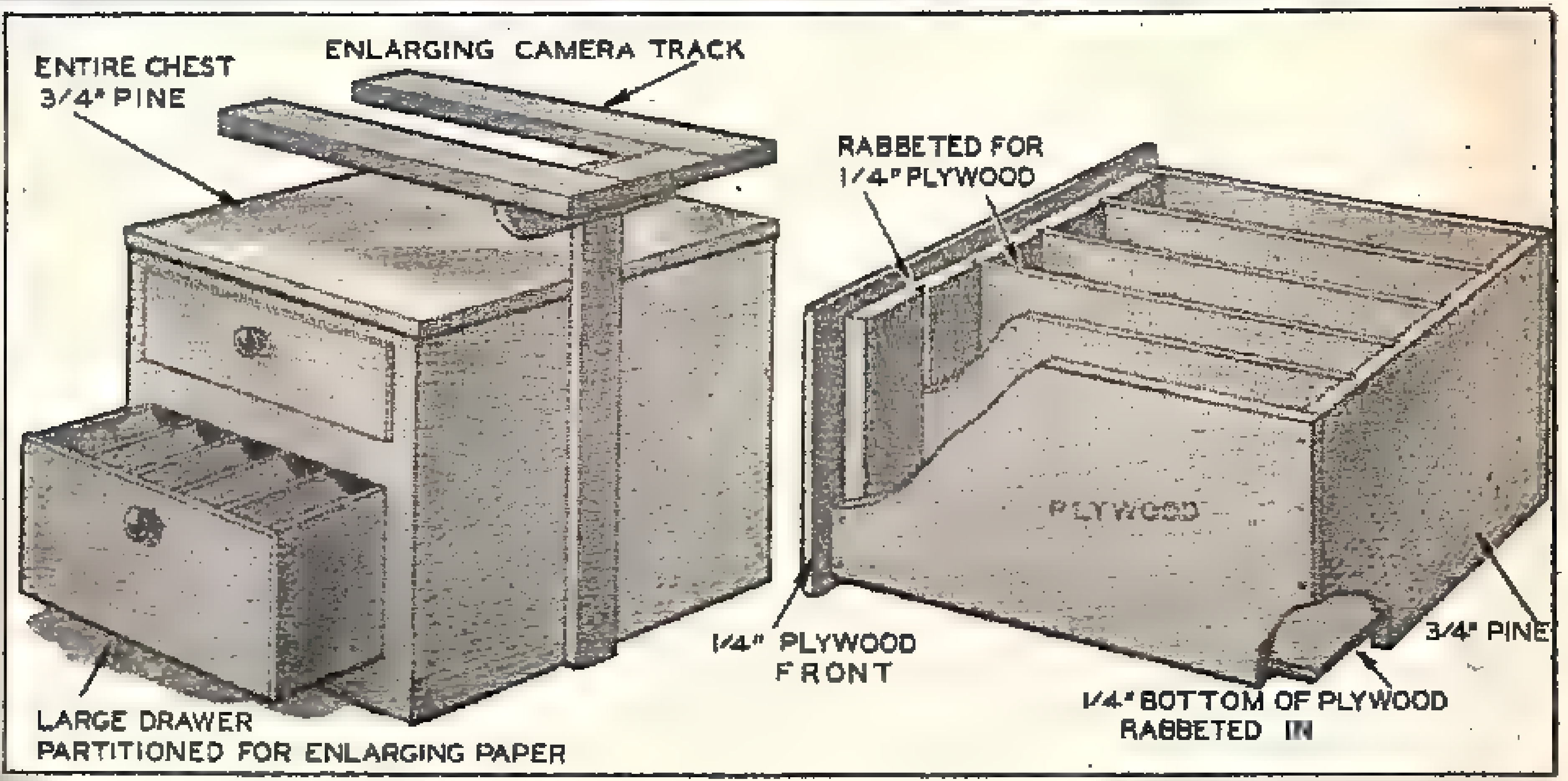
The photographs accompanying this article show how space is provided for chemicals, scales, graduates, trays, solution bottles and jugs, enlarger, cameras, lighting apparatus, and photographic literature. The original flour compartment was altered to make a vertical enlarger. Four lights were mounted near the top with a piece of opal or ground glass several inches below. Holes in the back were necessary to provide the ventilation for the light compartment, which is painted white or lined with tinfoil.

Below the diffusion screen are a series of slots in which the glass negative holder slides. This is merely a sheet of glass which forms a shelf on which the negative is placed, dull side down. It is covered with a clean piece of glass to hold the celluloid flat. By moving this glass shelf closer or farther from the lens, different degrees of enlargement can be obtained. The lens is mounted at the bottom of the compartment and should be adjustable for focusing. With the lens removed, a printing frame can be substituted for the paper holder and the light then used for printing contact prints.

This compact photographic laboratory is particularly adaptable and valuable to the man living in a small apartment. It will please the housewife, too, for it means that her photo fan husband will now have a "place for everything and everything in its place."



HANDY DRAWER FOR ENLARGING PAPER


ENTIRE CHEST 3/4" PINE
ENLARGING CAMERA TRACK
RABBETED FOR 1/4" PLYWOOD
PLYWOOD
1/4" PLYWOOD FRONT
3/4" PINE
1/4" BOTTOM OF PLYWOOD RABBETED IN
LARGE DRAWER PARTITIONED FOR ENLARGING PAPER

Built with two or three drawers, this chest holds photo supplies and provides support for enlarging camera track.

A COMPACT chest of drawers, built into the space under an enlarging camera, can be used to store photographic equipment. Making one of the drawers deep, with removable partitions, solves the problem of where to store large size enlarging paper.

The chest can be made to dimensions to suit the builder, using ¾-inch pine for all sides. The drawers can be made of lighter material, such as ¼-inch plywood, for the sides, bottoms and front, but use ¾-inch pine for the backs. The enlarging camera track can be attached to a wooden T and screwed to the side of the chest as shown in the sketch.

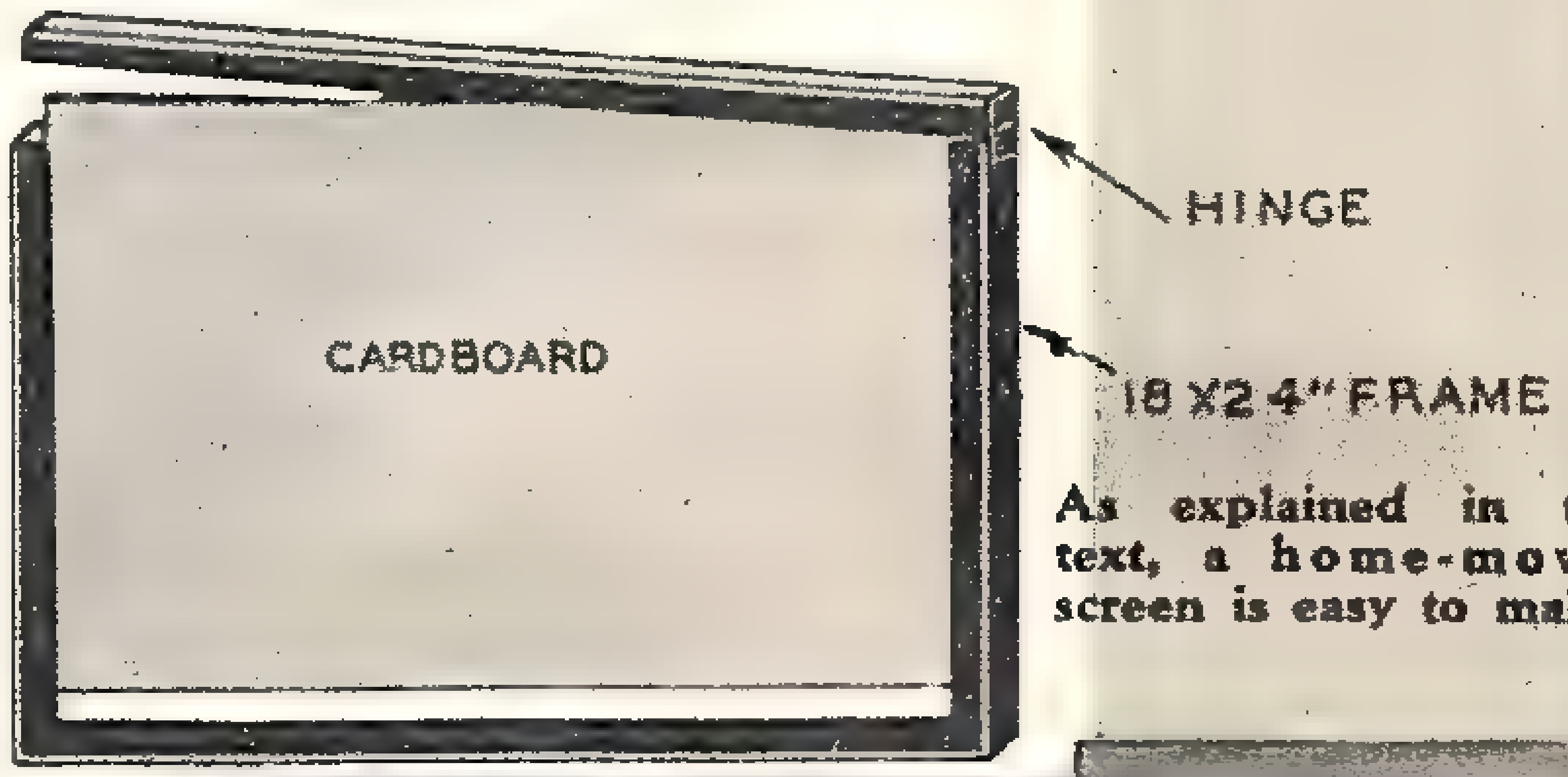
Build This Two-Purpose Movie Projection Screen

A DISCARDED picture frame, some bronze paint and enamel and a few pounds of glass beads are all that are required to make a novel back-of-the-door projection screen for showing home movies.

The picture frame should be hinged at one corner, as shown in the accompanying sketch, so as to enable the cardboard screen to be slid into position. The screen should be silvered on one side by applying silver bronze paint with a small brush.

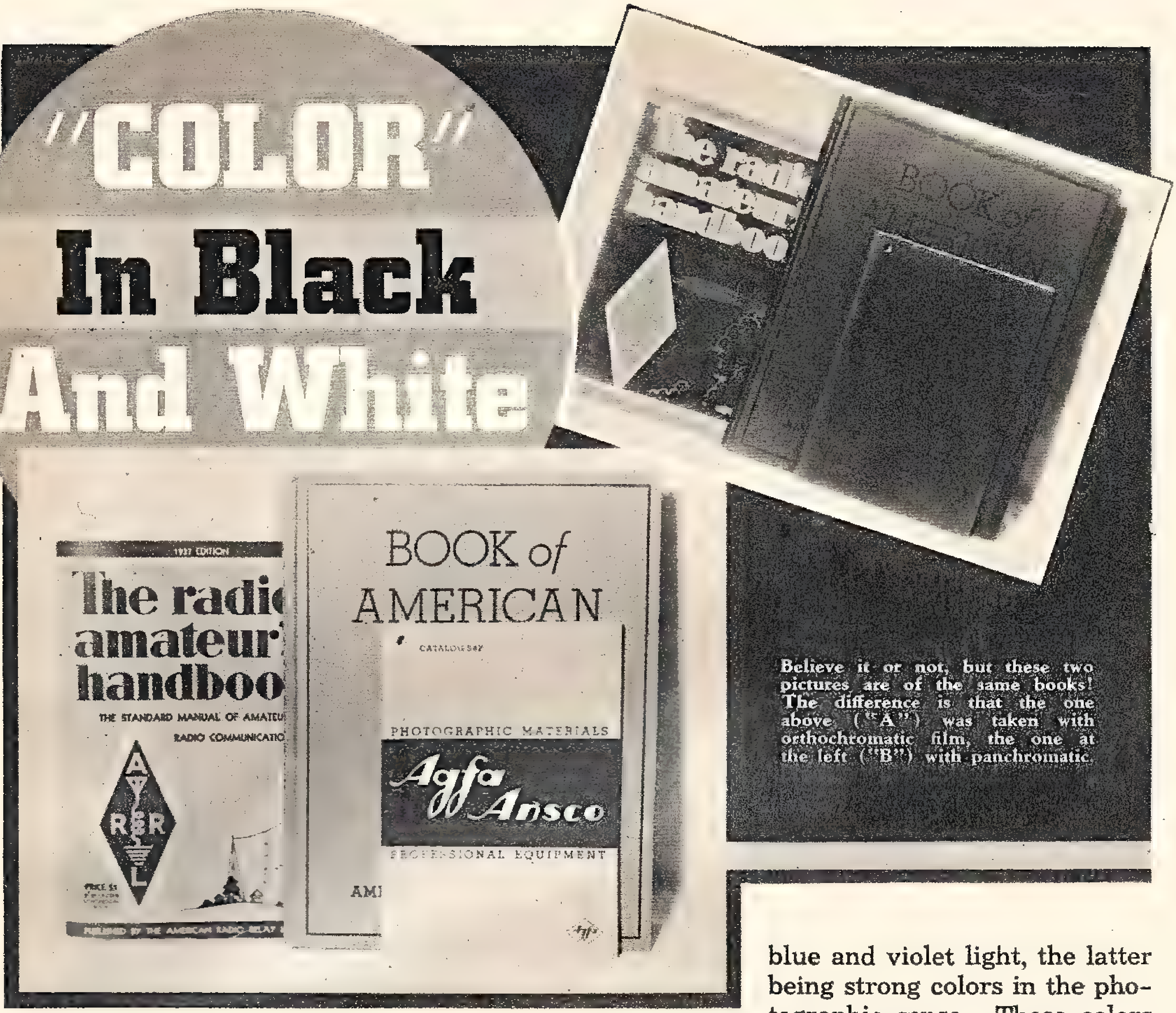
When dry, turn the cardboard over and spread white enamel paint on the untreated side. While this surface is somewhat sticky, sprinkle the entire surface with tiny white glass beads. Make sure the beads cover the entire surface smoothly and when the enamel has dried, turn the cardboard on edge and lightly brush off the superfluous beads.

The silvered side is useful for the projection of motion pictures in an ordinary manner, while the beaded side will create a novel effect because it provides better luminosity and greater depth to the projected pictures or lantern slides. Legs can be attached to the base of the screen so that it can be set up on a table, instead of being hung on a wall or door, if desired.



As explained in the text, a home-movie screen is easy to make.

"COLOR" In Black And White



Believe it or not, but these two pictures are of the same books! The difference is that the one above ("A") was taken with orthochromatic film, the one at the left ("B") with panchromatic.

PHOTO booklets of various kinds make many references to the "color sensitivity" of different kinds of films. This is very confusing, not only to beginners but to some experienced amateurs as well, because of the word "color."

We must remember that no matter what the colors of a scene or object are in natural life, ordinary cameras and films reproduce them only as different tones of black on white paper, or as black images on a white movie screen. This is why some people who have very vivid and interesting coloring in their hair, faces and eyes sometimes look dull and unattractive in a still picture or in the movies, and also why some people who look quite ordinary in the flesh express remarkable personality in pictures.

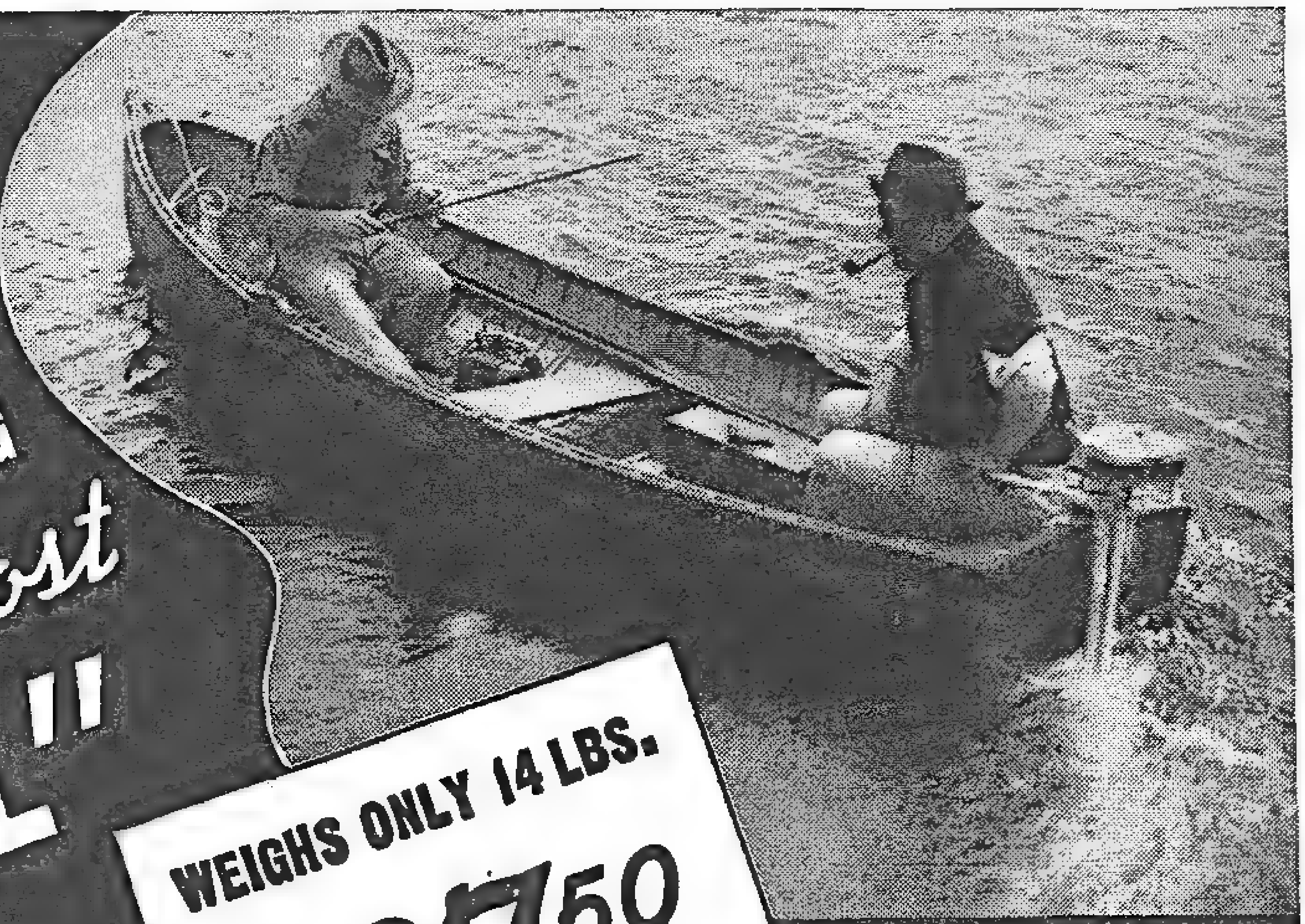
Depending on the kind of film and the design of the filter (if one is used over the lens), the colors of an object will register with varying shades of blackness. Films of the "orthochromatic" type, in general, are sensitive to yellow-green light in addition to blue and violet light, the latter being strong colors in the photographic sense. These colors show in the final print as variations of gray. However, red does not register at all, and any part of a scene that is red doesn't affect the film and therefore shows up as dead black in the print. "Chrome" type films can, for this reason, be developed safely under a red light.

"Panchromatic" films are sensitive, for practical purposes, to all colors that the human eye normally sees. "Super-sensitive panchromatic" film, now very popular with camera owners, is extremely sensitive to yellow, orange and red light, as well as to green, blue and violet. For this reason it can be developed only in total darkness. Reds and oranges no longer "blank" out, but register very nicely.

The remarkable difference between orthochromatic and panchromatic (don't let the words scare you!) film is illustrated by the two accompanying pictures. These were taken with the same camera and under the same light conditions, "A" with chrome film and "B" with super-sensitive panchromatic.

[*Continued on page* 130]

Enjoy OUTBOARD MOTORING at low cost "PAL"



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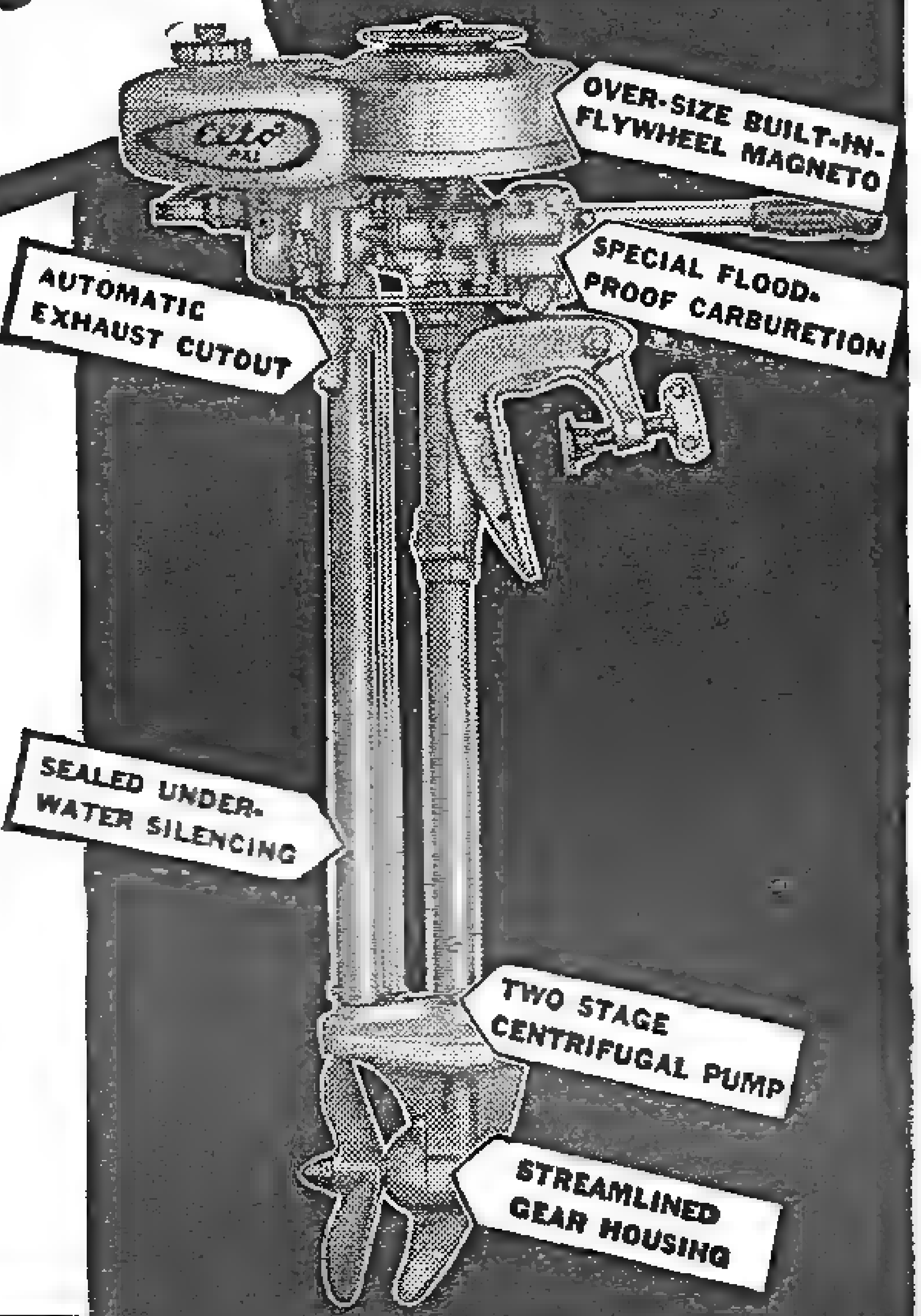
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SPECIAL FLOOD-PROOF CARBURETION
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SEALED UNDER-WATER SILENCING
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Most important of all features, the Pal offers *amazing starting ease* . . . even a young child can start it with an easy snap of the wrist. The simple, conveniently placed controls give finger-tip ease of handling.
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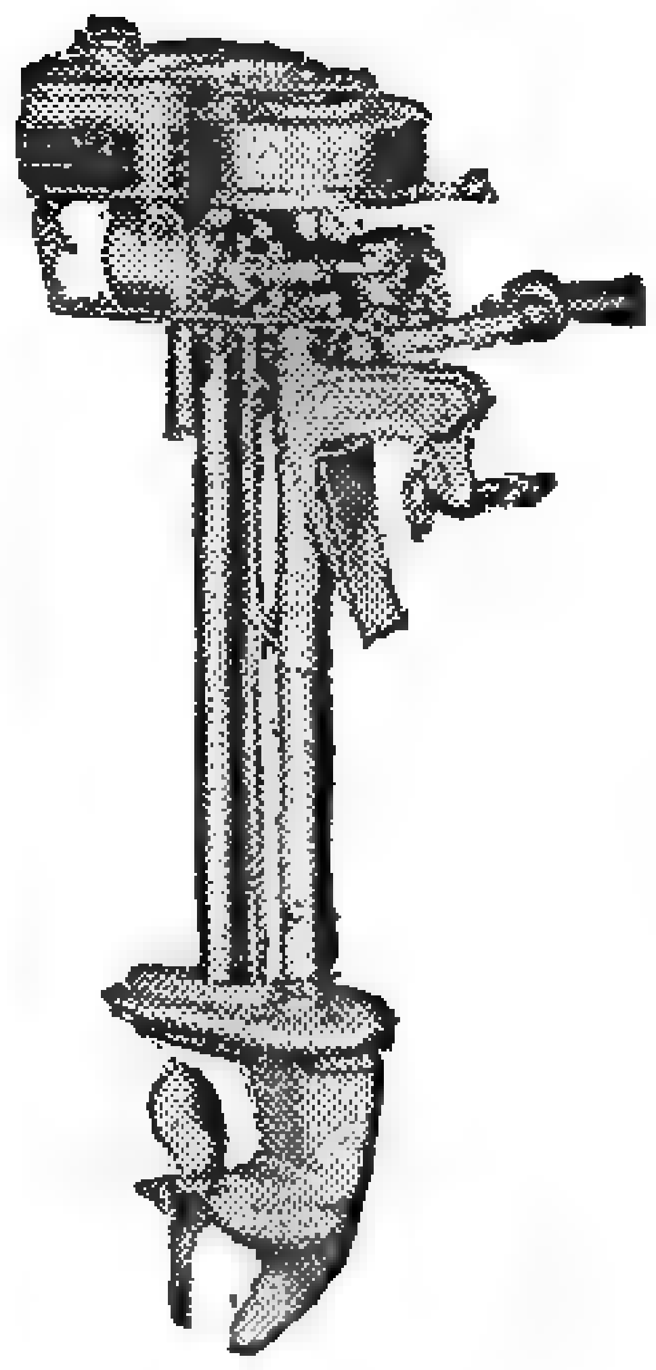

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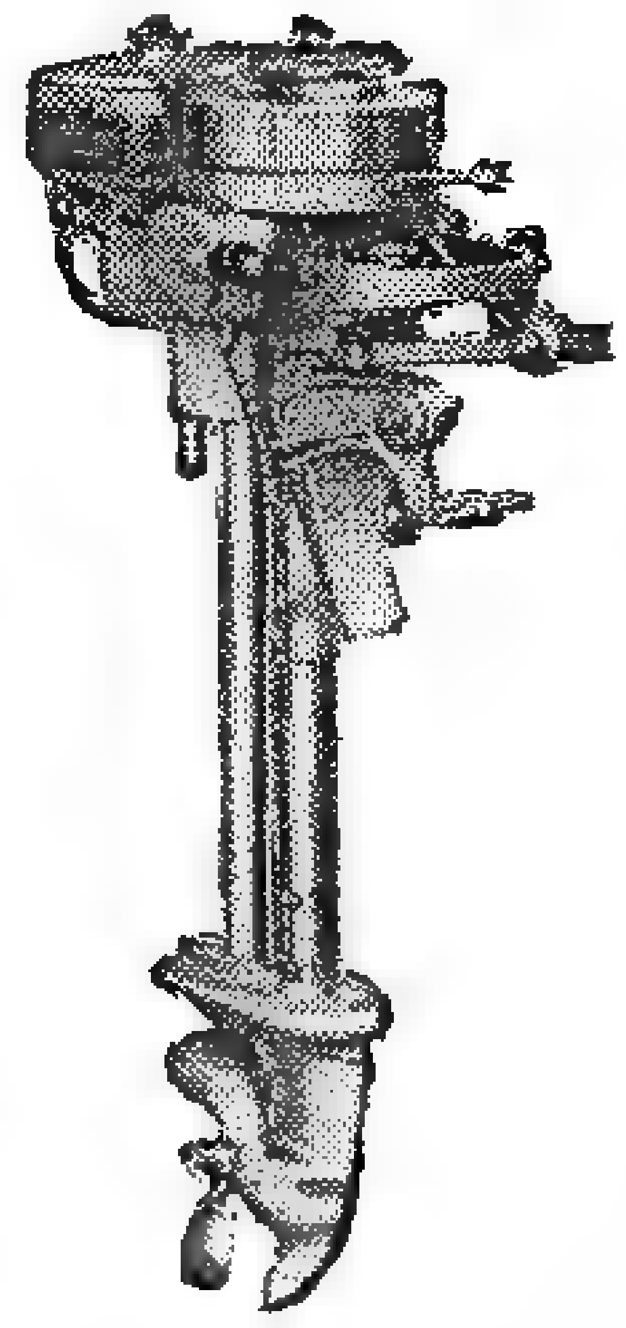

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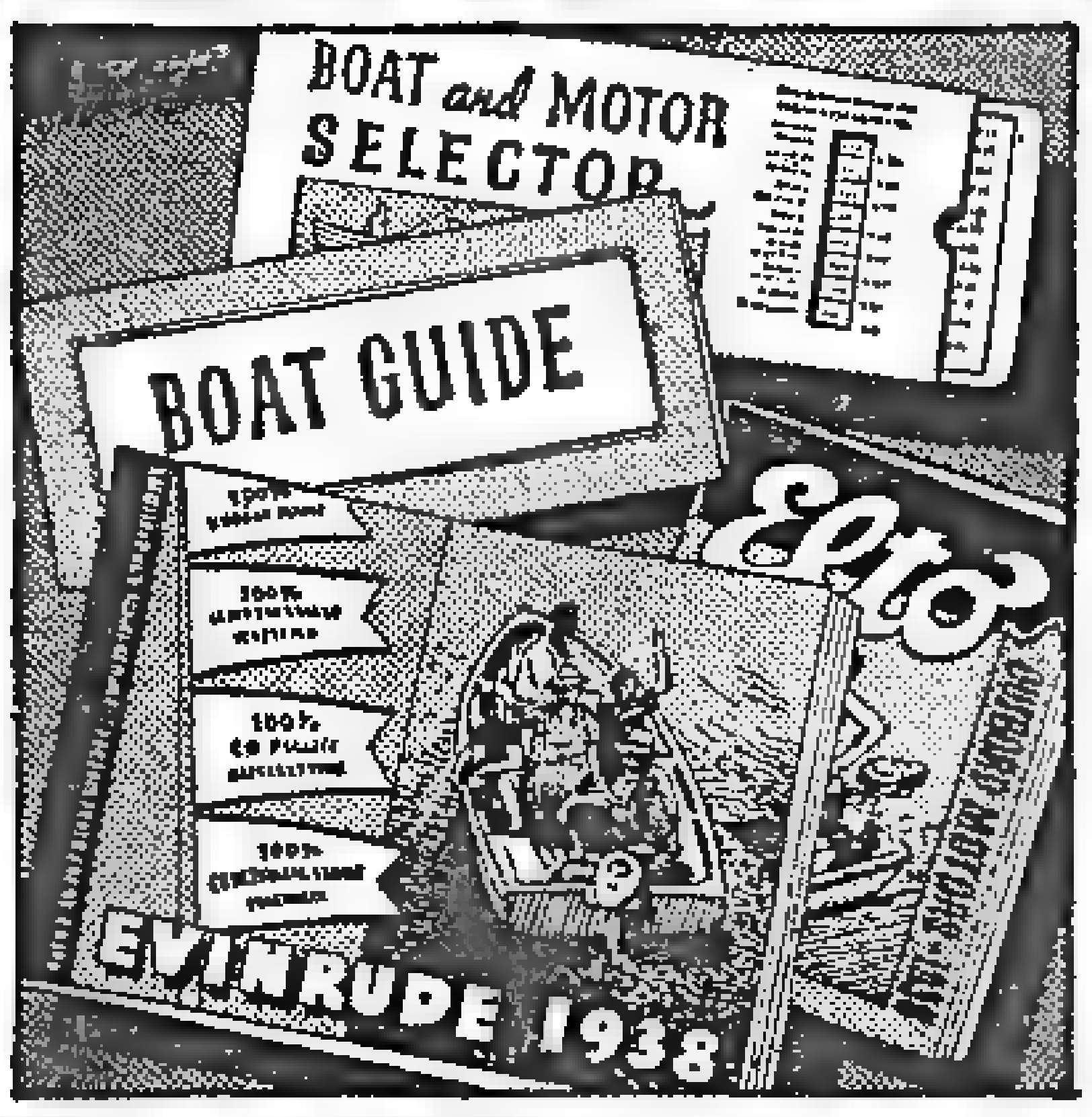
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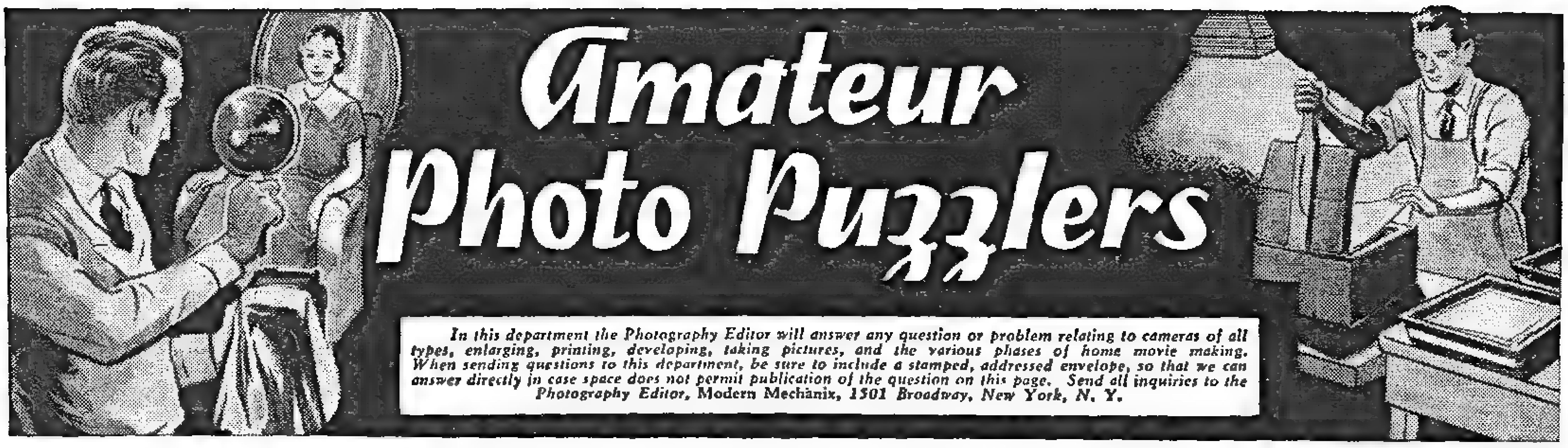

Amateur Photo Puzzlers

In this department the Photography Editor will answer any question or problem relating to cameras of all types, enlarging, printing, developing, taking pictures, and the various phases of home movie making. When sending questions to this department, be sure to include a stamped, addressed envelope, so that we can answer directly in case space does not permit publication of the question on this page. Send all inquiries to the Photography Editor, Modern Mechanix, 1501 Broadway, New York, N. Y.

RECOVERING SILVER

Please tell me how to recover the silver in hypo solutions. I understand some photographers make quite a bit of money this way.—E. S., Sturgis, Mich.

The recovery of silver from old hypo solutions is not worth the trouble and the cost of the necessary apparatus unless very large quantities of the chemical are available. The amateur photographer who uses perhaps a gallon or so of hypo per month should not bother with the idea.

SPOTS ON PRINTS

My negatives appear to be clean, but my enlargements invariably are full of little spots and small white lines. I wipe the rolls of films very carefully after washing, by means of a viscose sponge rung out in water. I also filter the print developer carefully before use. Can you offer any suggestions?—A. A. D., Long Island City, N. Y.

This trouble is probably due to tiny specks of dust and lint picked up by the negative after it has dried. Sometimes this dirt comes from the inside of the enlarger itself. If your enlarger negative holder uses a glass "sandwich," breathe on its surfaces lightly and rub them off just once with lens tissue before putting the negative in place.

FILTERS ON SMALL CAMERAS

Is there any reason why I cannot use filters on a small folding camera that cost about ten dollars, in order to obtain those beautiful sky and cloud effects I see in many exhibition prints?—R. S., Atlanta, Ga.

Certainly not! The size or price of a camera has nothing to do with its ability to use filters. By all means buy several filters of the correct size to slip over the lens cell.

ENLARGEMENTS FROM PRINTS?

I have a small but very clear picture of a group of children taken at a summer camp. Is there any way of making an enlargement from this, so that the picture of my own child stands out better? I do not have the negative, as the picture was taken by another visitor.—Mrs. D. B. H., Woodside, N. Y.

Enlargements can be made only from negatives, not from prints. However, if the print is clear, it is a simple matter to have it "copied"; that is, photographed by another camera so that a engative is obtained. From this copy negative, enlargements of any size and in any quantity can be made by ordinary methods. Any commercial photo-finishing establishment will do this work at a reasonable price.

PROJECTING PICTURES ON THE WALL

I am interested in projecting large images on a blank sheet of paper tacked to a wall, so that I can sketch in the outlines and thus make a unique kind of photo-poster. I rigged up my camera with a light reflector, so that it acts as a sort of enlarger or projector, and used my regular negatives, but the images appear to be reversed; that is, what should be black is white, and white, black. What's wrong? I thought I had fixed up the equivalent of a movie projector, but for "stills."—H. L. S., Los Angeles, Cal.

The image produced by a negative on white paper through an enlarger or projector of any kind is still a "negative" in the sense that the light values are reversed. In actual photographic enlarging, this image on sensitized paper becomes a "positive" only after the paper has been developed by chemical means. If you want to project an actual "positive" image, you must use a "positive negative," or, more correctly, what is known as a positive transparency. This is made by printing the negative on transparent film instead of on ordinary paper, so that light will shine through it.

All motion picture film, whether used in home or theatre projectors, is positive transparency film. What probably confuses you (and many other people) is the fact that 8- and 16-mm. amateur films are first developed as negatives, and then turned directly into positives by a trick "reversal" process. The film you get back for projection is the same roll you took originally in the camera. However, in commercial 35-mm. movie work, the original negative "shot" in the camera is developed only as a negative, and from this, duplicate positive rolls are made by simple contact printing.

Many owners of 8- and 16-mm. movie cameras attempt to make enlarged prints from individual frames, and are puzzled when they obtain reversed prints. This is to be expected, as the film is a positive. A contact negative must be made first, and this used in the enlarger to produce a positive print.

ENLARGER FOR BATTERY SERVICE

I work in a camp removed quite a distance from 110-volt power lines. We make our own electricity with a gasoline engine driving a 32-volt D. C. generator. This is very satisfactory for general purposes, but I want to do all my own developing and enlarging and all the machines I see in the catalogs are designed for 110 volts. I intend to make a contact printer like the one described in your December, 1937, issue, and also an enlarger. What changes are necessary to adapt these to 32 volts direct current?—A. C., Denver, Col.

None whatsoever. A 25-watt bulb working on 32 volts gives as much light as a 25-watt bulb working on 110 volts. You can use safelights, contact printers and enlargers without change. You will not be able to use an electric clock for timing purposes, but there are many spring-operated photo timers that serve the purpose very nicely.

WASHING PRINTS

I see many conflicting instructions about washing prints. Some say let them wash 15 minutes, others 30 minutes, an hour, even two hours. Which is correct?—W. L., Pearl River, N. Y.

Washing time really depends on how fast the water is running, and how well the prints move around in the basin or tray. Prints that are not thoroughly washed start to fade, sometimes only a few months afterward. About the minimum washing time is thirty minutes. An hour of vigorous washing is better and will produce prints that will never fade.

MODERN MECHANIX AWARDS $40 EACH MONTH FOR BEST PHOTOS SUBMITTED BY READERS

The editors of Modern Mechanix distribute $40 in cash awards each month to the five persons who, in their opinion, submit the best pictures suitable for publication in the Modern Mechanix Photography section. Full particulars regarding these awards will be found in this issue on page 103.

An exciting new field for your picture-taking skill

Snapshots at Night

ALL YOU NEED—

Your present camera loaded with Kodak "SS" Film

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Super Sensitive
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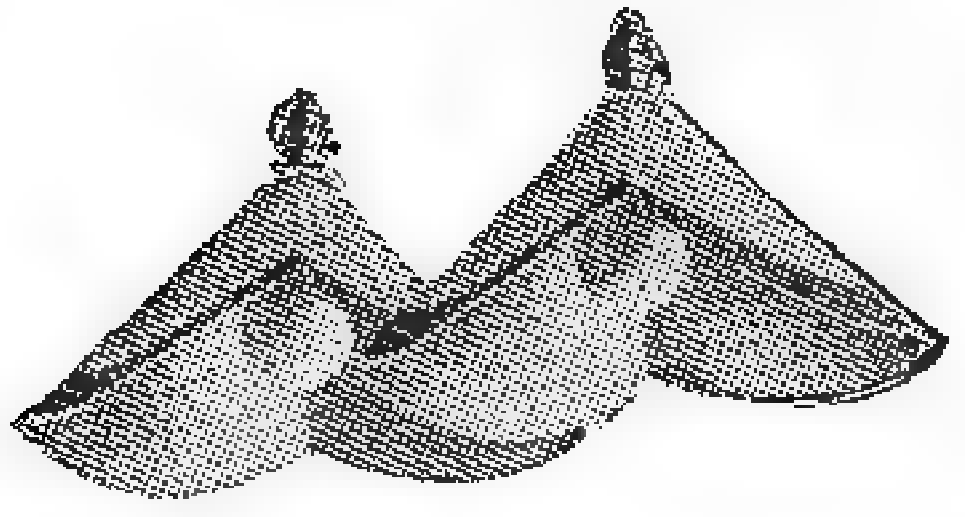
Two or three Photoflood lamps in Kodak Handy Reflectors



SNAPSHOOTING indoors after dark, you discover scores of new and fascinating picture chances. You get good results from the start, and really great snapshots as you become increasingly skillful in placing your subject, arranging your lights.

The equipment is both simple and inexpensive. You don't need a high-priced camera. Any camera that can be loaded with Kodak "SS" Film will do the trick—even the simplest Brownie.

With "SS" Film, you use two or three of the new No. 2 Mazda Photoflood lamps, which last for hours, together with inexpensive Kodak Handy Reflectors. If your particular camera is equipped with an *f*.6.3 or faster lens, then No. 1 Photoflood lamps are quite powerful enough.

HOW TO MAKE
SNAPSHOTS
AT NIGHT
with your camera

FREE BOOKLET . . . Suggests a variety of picture opportunities . . . shows you how to arrange your lights . . . how to place your subject . . . tells you everything you need to know about two ways to make night pictures—*snapshots* with Photoflood lamps, *fast exposures* with Photoflash lamps. (You can use Photoflash lamps, each good for one picture, if your camera can be set for "time.") Get a copy at your dealer's today . . . Eastman Kodak Company, Rochester, N. Y.

Follow The Fleet

[*Continued from page* 52]

to operate their cars is because they do not enjoy sufficient mileage. Once a car is warmed up and ready for action it operates more efficiently and thus more cheaply. Taxi companies long ago found out that it paid them to keep the engines running all day, especially in cold weather. Heavier oil could be used, and there were none of the usual periods of cold starting, over-choking and overloading. Traveling men seldom need to have the head removed and the valves ground, because most of their mileage is done at peak efficiency. Carbon is built up largely in around-town driving, especially when there are frequent stops and periods of parking.

The question of when to trade in for a new car is no problem to the fleet operator. One form for reaching this decision gives something of a case history of the car as well as of its driver. On the reverse side of the report of the total cost of the various expense items is a place on which the driver lists all repairs, accidents and other points in connection with the car. Mileage on present tires is also recorded. If the car appears to have reached the point where it needs an engine overhaul, a new clutch, a new rear end or some other major work it is likely to be traded in immediately. Repairs are tolerated only so long as they represent an opportunity to increase or maintain efficiency.

The cost of accidents shows up plainly on expense records. This is one reason why fleet operators are noting an improvement in their accident experience. Safety students claim that defective mechanism accounts for only a small percentage of automobile accidents, but the experience of fleet operators indicates that where cars are better cared for they are better driven.

Personal contact is one of the reasons for the success of fleet management. Someone usually goes with the car to the service station and follows it through the work. This not only assures better work, but helps to lessen the chances of an oversight. Many worthwhile savings are also effected when the mechanic can discuss the matter with a representative of the fleet management. Because all service of importance has to be given the approval of the management there are no opportunities for costly experiments.

Fleet operators warn of the importance of drawing a distinction between operation and main tenance. Most drivers try to reduce operating costs, even though they may fail to do this properly, but in aiming for such savings they are apt to be "penny wise and pound foolish." Only through spending the necessary amount of money on maintaining the car in good condition is it possible to keep operating costs from going out of bounds. New spark plugs every 8,000 miles is an item of maintenance needed to keep gasoline mileage up. New breaker points also illustrate

[*Continued on page* 132]

War Machines Needed, U. S.

[*Continued from page* 39]

The Air Corps now has about 1,000 modern fighting planes. The present program calls for bringing this force to 2,350 planes by 1940. This number should be adequate, but more trained pilots will be needed. The Air Corps is already taking steps to train these pilots.

The common soldier can be trained in a few weeks, but trained officers to lead them, and the trained technicians needed to handle modern weapons and technicians cannot be produced in a hurry. We already have the R. O. T. C., which gives officers their basic training, but funds should be provided to give at least half of these reserve officers training every year. An enlisted reserve of at least 150,000 should be provided as a reservoir for trained technicians. The Army has no enlisted reserve now; though one is maintained by the Navy and Marine Corps.

And finally, the factories which are to manufacture the intricate mechanical equipment needed for modern warfare should be given small sample orders, so that the machinery and tools will be on hand, and that at least a few men be trained in their use.

MM Short-Wave Transmitter

[*Continued from page* 101]

quality with no fear of insulation breakdown.

After tests are completed and quality is found to be satisfactory, the modulator can be connected into the Class C circuit. Here again, apply a load to the tank so that the Class B output impedance will match that of the Class C input. The builder will save considerable trouble by reducing plate voltages to the final and modulator during these tests. The builder will do well to keep in mind that before power is applied to the transmitter, some provision must be made for taking up the resultant energy. When 400 watts or more go into an amplifier, to say nothing of when it is plate modulated, each watt will account for itself in some manner. It is the builder's problem to see that they are sent along the right path.

When tests are completed, connect the antenna, and give the rig the greatest test of all, a QSO.

NOTICE

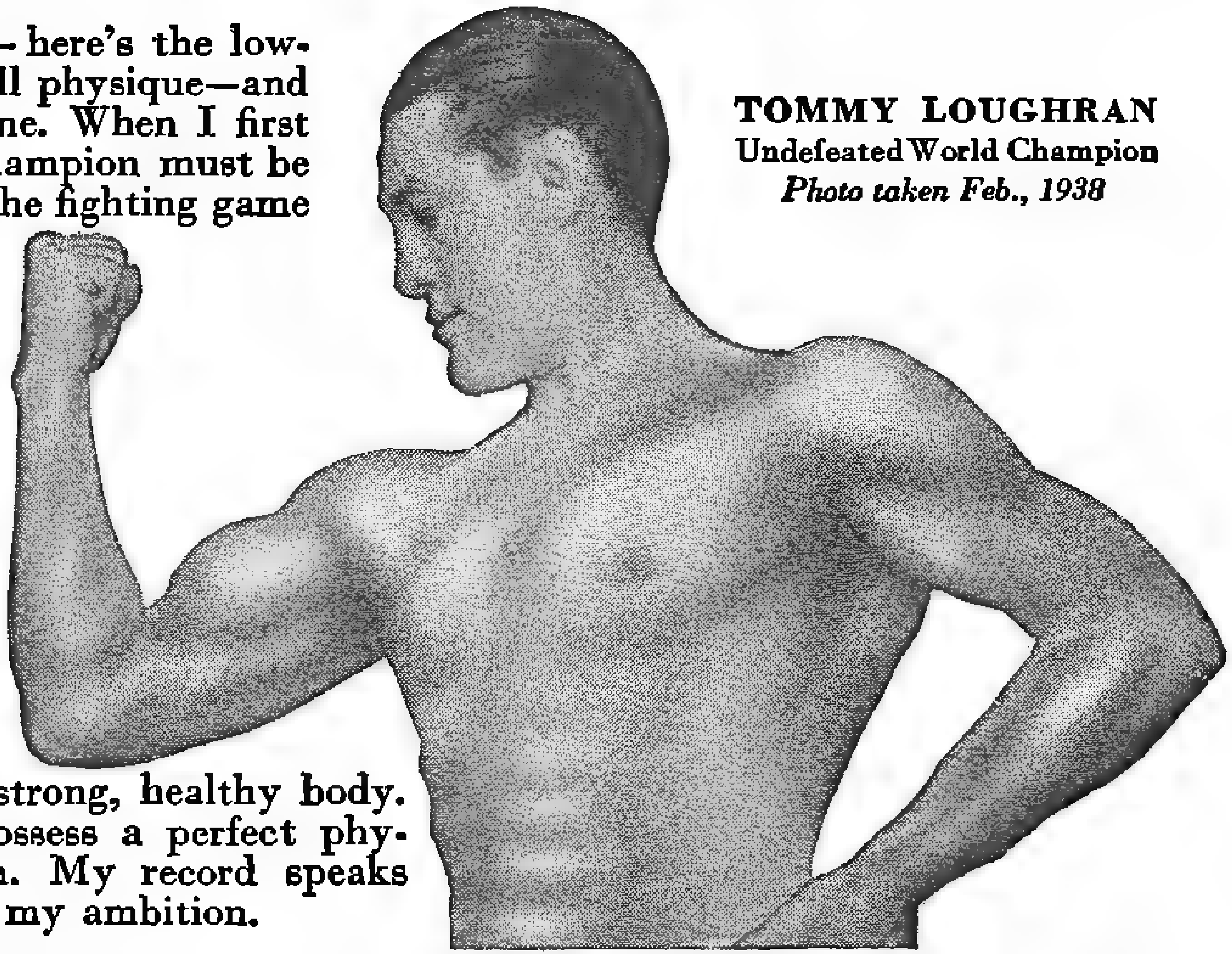
Changes in the make-up and title of this magazine, designed to make your favorite publication better than ever before, will be announced in our next issue. Be sure and reserve your copy now.

A WORLD CHAMPION

TELLS HOW TO

BUILD A POWERFUL BODY

THE SECRET'S OUT: Well, fellows — here's the low-down. Don't think I always had this swell physique—and don't think it just naturally grew on me. When I first started boxing, I was tipped off that a champion must be able to take it — as well as dish it out. The fighting game is hardly a ping-pong contest. You have to meet not only scientific boxers but human gorillas. To stand up and swap punches for twelve and fifteen rounds requires an enormous amount of energy and stamina—That is why it was necessary for me to first build up a sturdy frame work for my body before I could ever amount to anything as a fighter. And that is just what I did.



TOMMY LOUGHRAN
Undefeated World Champion
Photo taken Feb., 1938

A NEW LIFE To win my first important fight was nothing compared to the joys I experienced from possessing this strong, healthy body. From that day on, I decided I would possess a perfect physique as well as be a boxing champion. My record speaks for itself as to whether I accomplished my ambition.

All these years while I was working my way to the top, I kept investigating and studying every known method of physical development until I finally discovered the secret of "PUISSANT POWER."

227 fights in 18 years

That's stamina and muscle power. How did I do it? That's my secret. I'll reveal it to you.

Learn from a Champion

It took me years of study and research — also **thousands of dollars to acquire this knowledge of building muscles which possessed the power of an ox, but the speed and agility of a panther.** These are the **only type of muscles which** enable you to engage in active sports or to really accomplish anything. It was not long until I was receiving offers galore, if I would only impart this knowledge and train others through this short but certain method of body building. Days were all too short to satisfy the demands on my time. I decided to have duplicates made of my apparatus and put the instructions into printed form. In this way I am now enabled to spread the joyful message to the world.

Send For My FREE Book, "Puissant Body Building"

This contains numerous photos of some of the athletes and strong men I have trained. It will be an impetus and an inspiration to you. I don't ask you to buy it. I want to spread the glad news. It is absolutely *free.* Yours to keep. *Don't delay.* This does not obligate you in any way whatever. It is merely an inspirational talk and will show what I have done for so many others.

TOMMY LOUGHRAN
Dept. 14 4 So. 15th Street, Philadelphia, Pa.

FREE

For the next thirty days only will I send you with my free book, a beautiful reproduction of my portrait, made by a famous artist. This drawing has never been used in newspapers or magazines. And only those who send for my booklet will have this autographed reproduction.

COME TO ME

Do you wish these mighty dynamic muscles for yourself? Would you like to feel the joys of a strong, healthy body? Write me at once and I will tell you how you can not only be the envy of your friends from an outward physical viewpoint but I will also build up those inner muscles around your vital organs. You will feel the thrill of a new life pulsing through your veins — you will feel like shouting to the world "I am a man and I can prove it."

TOMMY LOUGHRAN, Dept. 14
4 So. 15th Street, Philadelphia, Pa.

Dear Tommy: —Please send that book "Puissant Body Building." I want a strong, active body like yours. This book is absolutely FREE with the understanding that I am not obligated in any way.

*Name*________________________________

Street ________________________________

*City*____________________ *State*__________

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LIQUID GLUE

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For craftsmen and manual training.
Use for fixing and repair work.
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MAC METHOD, Dept. G-2053, Cincinnati, Ohio

Pocket Electro Plating Outfit

[*Continued from page* 80]

Small pieces of solid gold or silver can be cut from pieces of old jewelry. Only a small quantity will be required, and to "recharge" the electrodes with more of the precious metal all that you have to do is to pull the glass tube from the cork and drop in some more pieces.

When you replace the glass tube in the cork cemented to the bottle cap, the carbon rod should make contact with the pieces of anode metal. When the electrode is dipped into the bottle of plating solution, the latter will soak the flannel and cotton, and wet the silver or gold anode metal. This makes an electrical circuit.

To proceed with your first plating job, the article to be plated *must* be clean and free of grease, otherwise the work will be uneven and streaked. Professional workers use a strong caustic solution, but with small articles you can do very well by scrubbing them with strong soap solution. If the surface is not absolutely smooth, it must be polished beforehand. You can then grip it with the spring clip connected to the negative (zinc) side of the battery, and rinse it in clean water.

If the article is of copper or brass it should first be given a coating of mercury, to serve as a bonding agent for the gold or silver to be deposited. Merely swab it with the mercury solution until it has an even, silvery appearance. Then rinse it in clean water again.

Connect the wire from the positive (carbon) side of the battery to the connector on the gold or silver electrode, and remove it from the bottle. Holding the electrode by the bakelite bottle cap, gently swab the wet flannel at the end of the glass tube over the surface to be plated. Keep it moving slowly. Almost at once you will see the deposited gold or silver "flow" onto the work in a brilliant film. Continue until the plating is as heavy as you wish it to be. The plated article should then be well rinsed, dried, and burnished by rubbing it with a rouge-treated polishing cloth.

If the gold or silver deposits very slowly, it is

[*Continued on page* 133]

Flower Pot Shell

[*Continued from page* 71]

cutoff to meet it from the other. When you see light through the intervening wood, turn off the motor and finish the turning by hand, using the point of a knife for the final cut to prevent throwing the piece onto the floor.

Place a bit of glue in each groove, then assemble the strips one at a time, spacing them as evenly as possible. The shell can be painted any suitable color or colors, or it can be made of walnut or gum and finished in natural with lacquer or varnish A bit of felt can be glued to the bottom. For pots of other sizes, vary the file tang grooves and strip lengths accordingly.

New Delta Utility Lathe

Here is the ideal general utility lathe—for the school shop—for the general woodworking shop—for the home workshop—you will find it in this new lathe. Can be adapted for metal-turning. A heavy, rigid bed of fine-grained cast iron, with accurately machined and polished ways . . . a substantial cast-iron headstock, with built-in, removable belt guard . . . four-speed efficient V-pulley drive with double-row indexing mechanism for dividing, fluting, etc . . . heavy steel hollow spindle, threaded front and rear for faceplates, etc., and with No. 2 Morse-taper centers . . . carried on pre-loaded New Departure self-sealed bearings which never require lubrication . . . exceptionally handy, free-moving universal tool support, locked to bed at any angle by convenient handle at front, and fitted with two tool rests . . . substantial cast-iron tailstock, locked by front lever, and with self-ejecting center actuated by large, convenient ball-end crank handle. Get the full story of this remarkable new lathe!

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Check the proper square in the coupon below and you will be sent the special circular giving full details and prices on the new Utility Lathe. If you have not received the 1938 Delta Catalog showing the complete line of latest Delta motor-driven tools—send the coupon for your copy as well as special circular on new Utility Lathe—and the latest Delta Project Book No. 4—packed full of new and different things to make, with many photographs, working drawings and complete instructions. Enclose 10c for Project Book. Catalog will be mailed postpaid.

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DELTA MANUFACTURING CO., Dept. M438
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The undersigned being duly sworn says: **"5 MILES MORE PER GALLON"** F. L. Van Ness, Mich.

Write for More Statements

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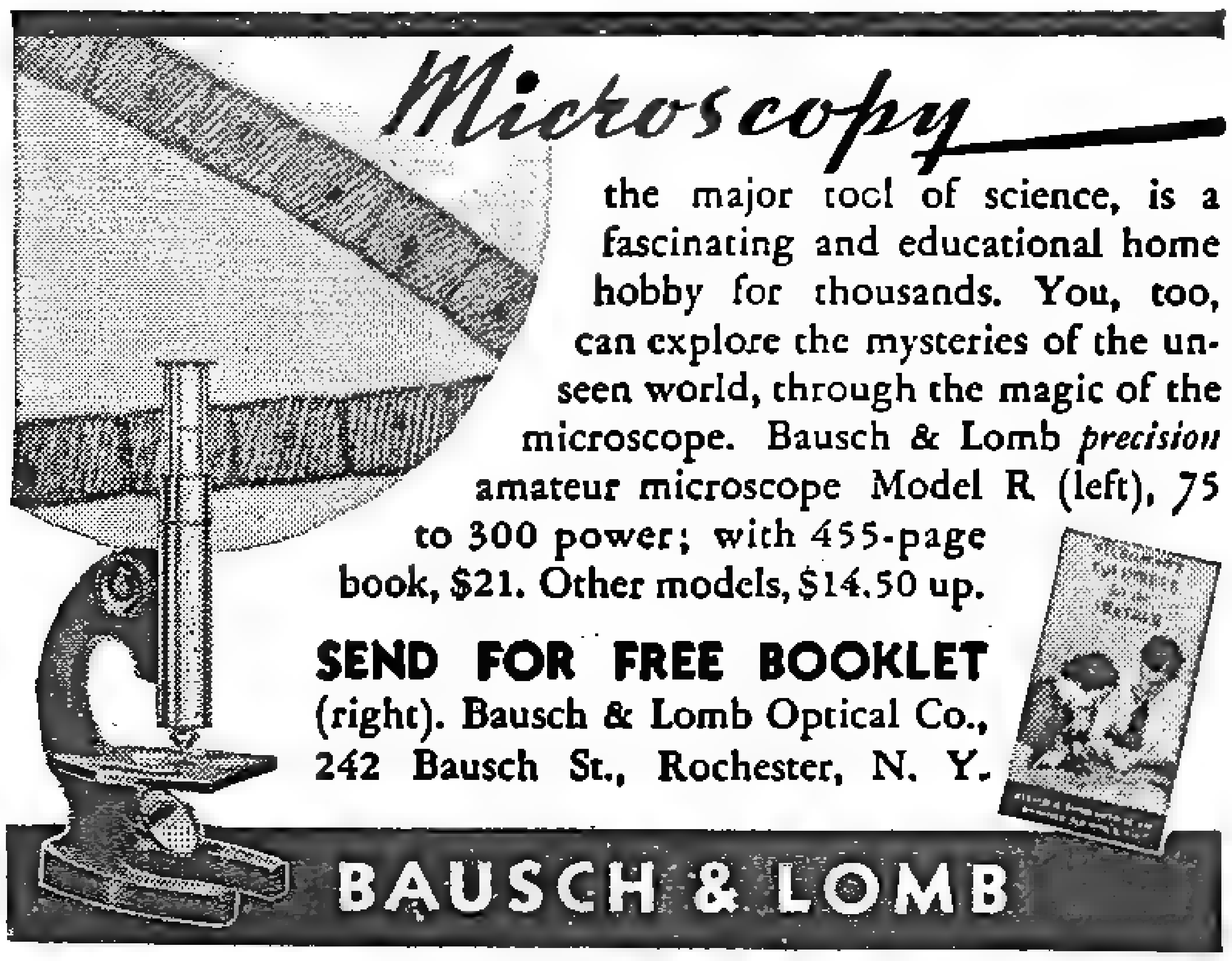

Microscopy the major tool of science, is a fascinating and educational home hobby for thousands. You, too, can explore the mysteries of the unseen world, through the magic of the microscope. Bausch & Lomb *precision* amateur microscope Model R (left), 75 to 300 power; with 455-page book, $21. Other models, $14.50 up.

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BAUSCH & LOMB

Documentary Evidence

[*Continued from page* 88]

a mere signature, as on a will or check, and and may be done freehand or by the method of tracing. The crook procures a genuine signature from a letter, cancelled check, autograph, etc. If he is an accomplished penman he may decide on the freehand method, whereby he will school himself by hours of copying the original, practicing until he can dash it off without effort or hesitation.

Detection here involves relatively high magnification so that the slightest characteristic may be thrown up in bold relief in an endeavor to find something the forger overlooked. In the tracing method the culprit employs a frosted glass plate with a light beneath, place the genuine signature on this illuminated plate and the document he wishes to forge on top, centering it so that he can directly trace the signature upon the space provided for this purpose.

He may execute the tracing very carefully and the finished piece of work may very closely resemble the original, but when enlarged the spurious name will show certain features that go along with this method. There will be evidence of tremor, the lines wavering ever so slightly because of the slowness of execution and the effort to trace accurately; the tracing lacks the bold sweeps, free from tremor, of the natural signature. There will be retracings, where the pen has been lifted during a pause and again applied to the paper, leaving slight blots and tails of lines that only the microscope can detect. And there will be evidences of hesitation, with tiny spots of ink where the pen has rested, be it ever so fleetingly, when it should not have paused at all. The binocular microscope, especially, is the bane of the forger.

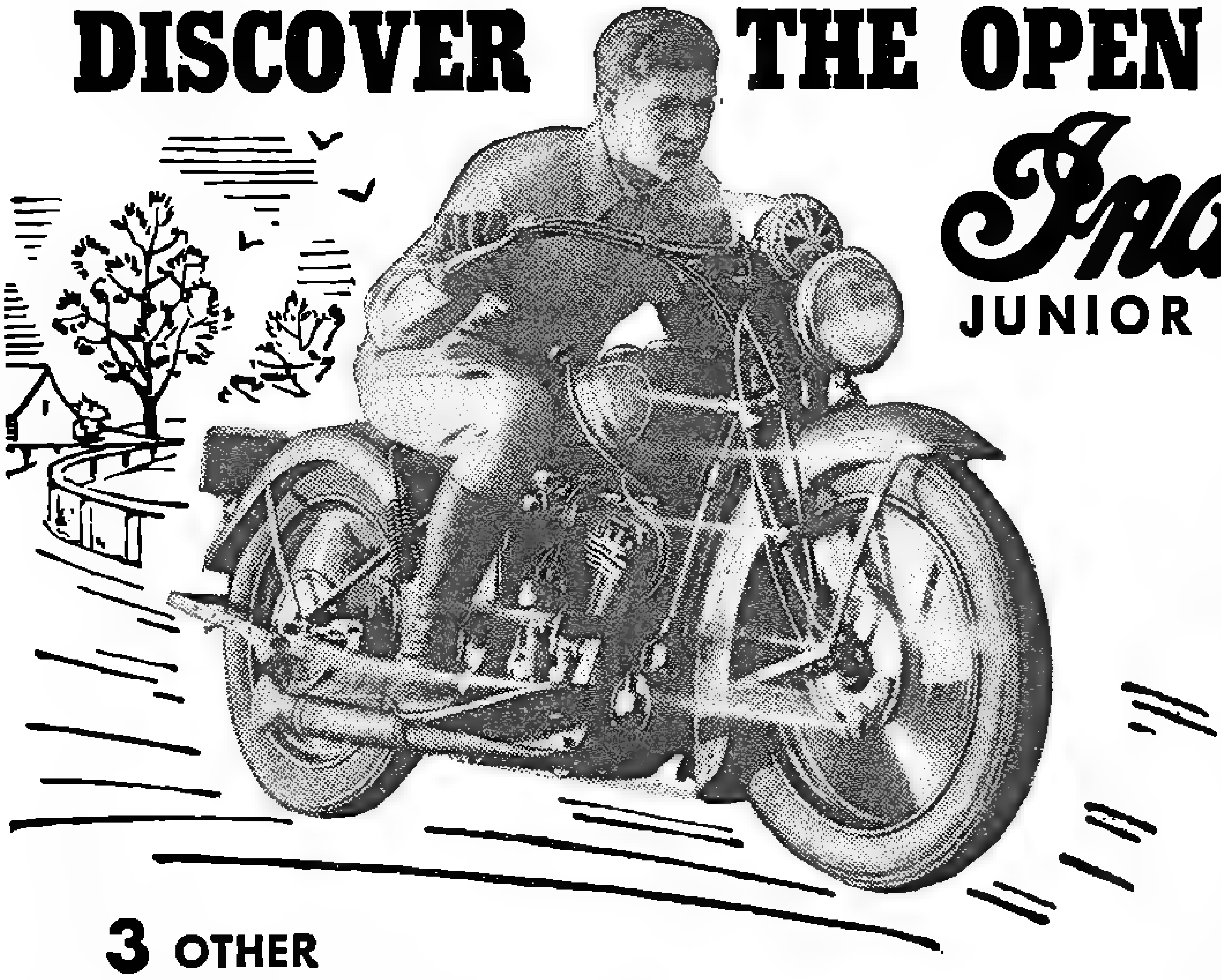
Here too you can arrange an entertaining experiment by having a friend sign his name to a card, and another person copy this signature by the tracing method. The two cards are given code numbers unknown to you and your job is to study the two and state which is the genuine, which the forgery. With the foregoing explanations and the accompanying photographs, can you do it?

The once-common crime of check raising has been greatly curbed by the use of mechanical check writers, which punch the amount into the paper as well as ink it into the fibers, and by new types of paper so treated that any alterations, by mechanical or chemical erasers, rub off the complex colored or printed pattern of the surface and leave glaring white blanks in their place. However, not everyone owns a check writer and there are ways of raising amounts without recourse to erasures.

Two illustrations show how this is done. As an example, write the amount "one hundred" on a card. When this is dry, make a C-shaped loop on top of the capital O, converting this letter into a

[*Continued on page* 133]

DISCOVER THE OPEN ROAD



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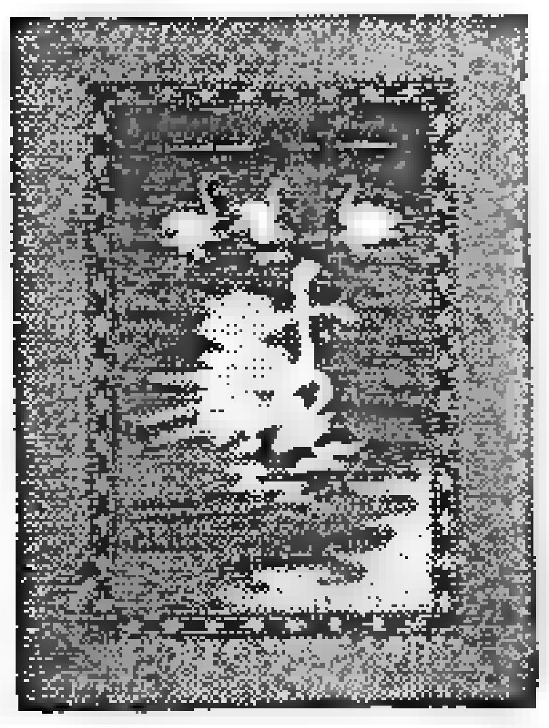

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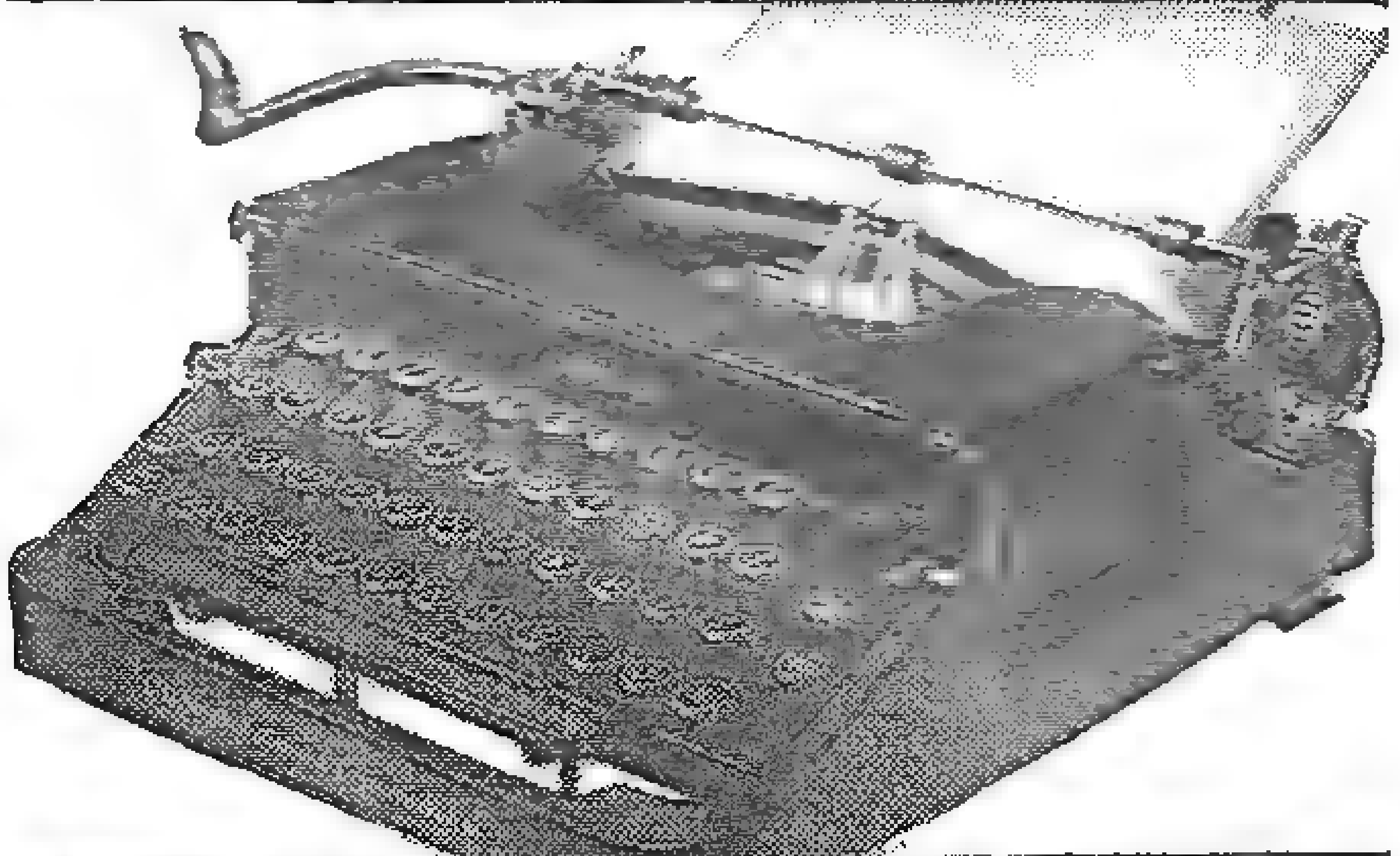

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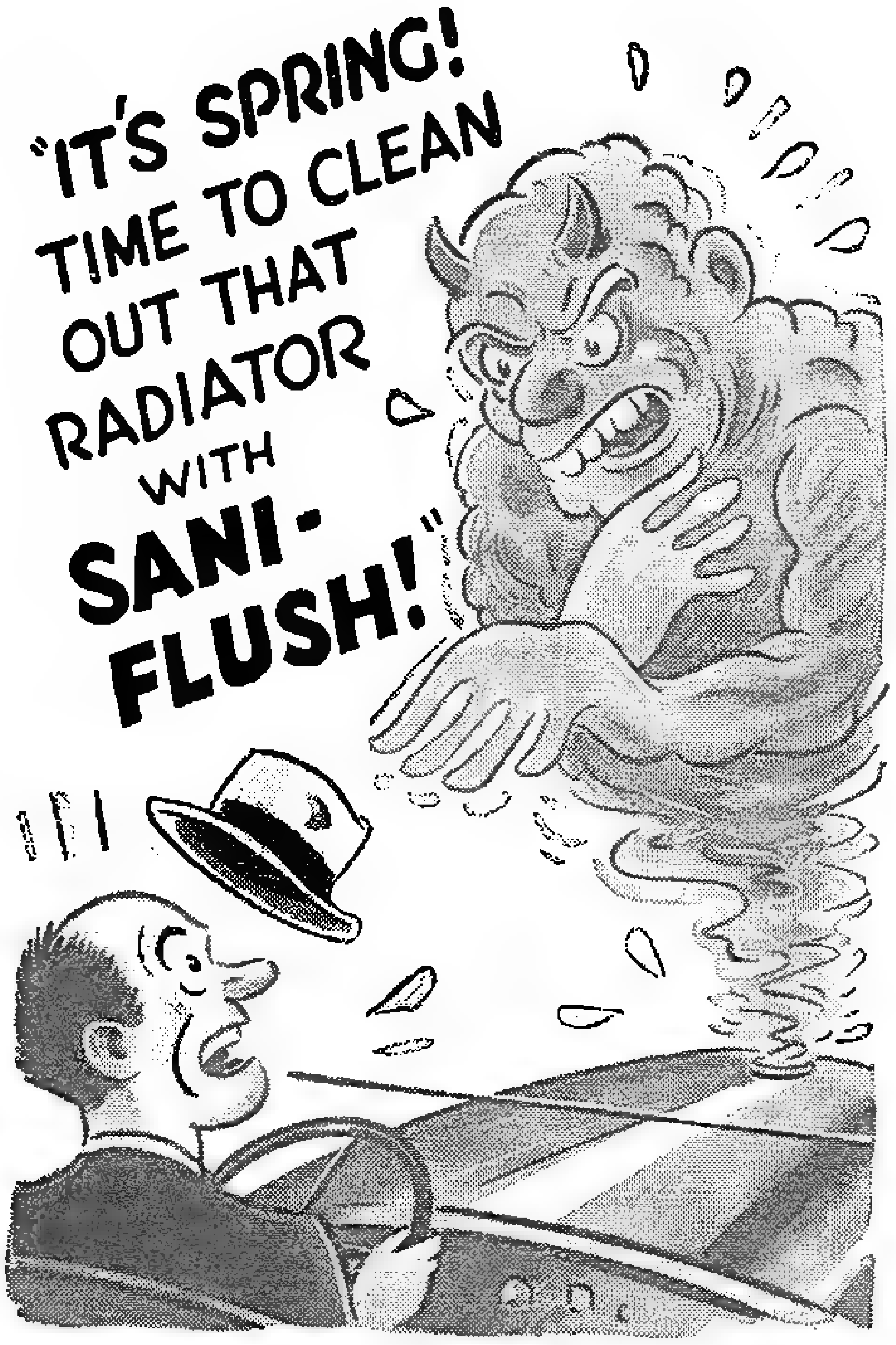

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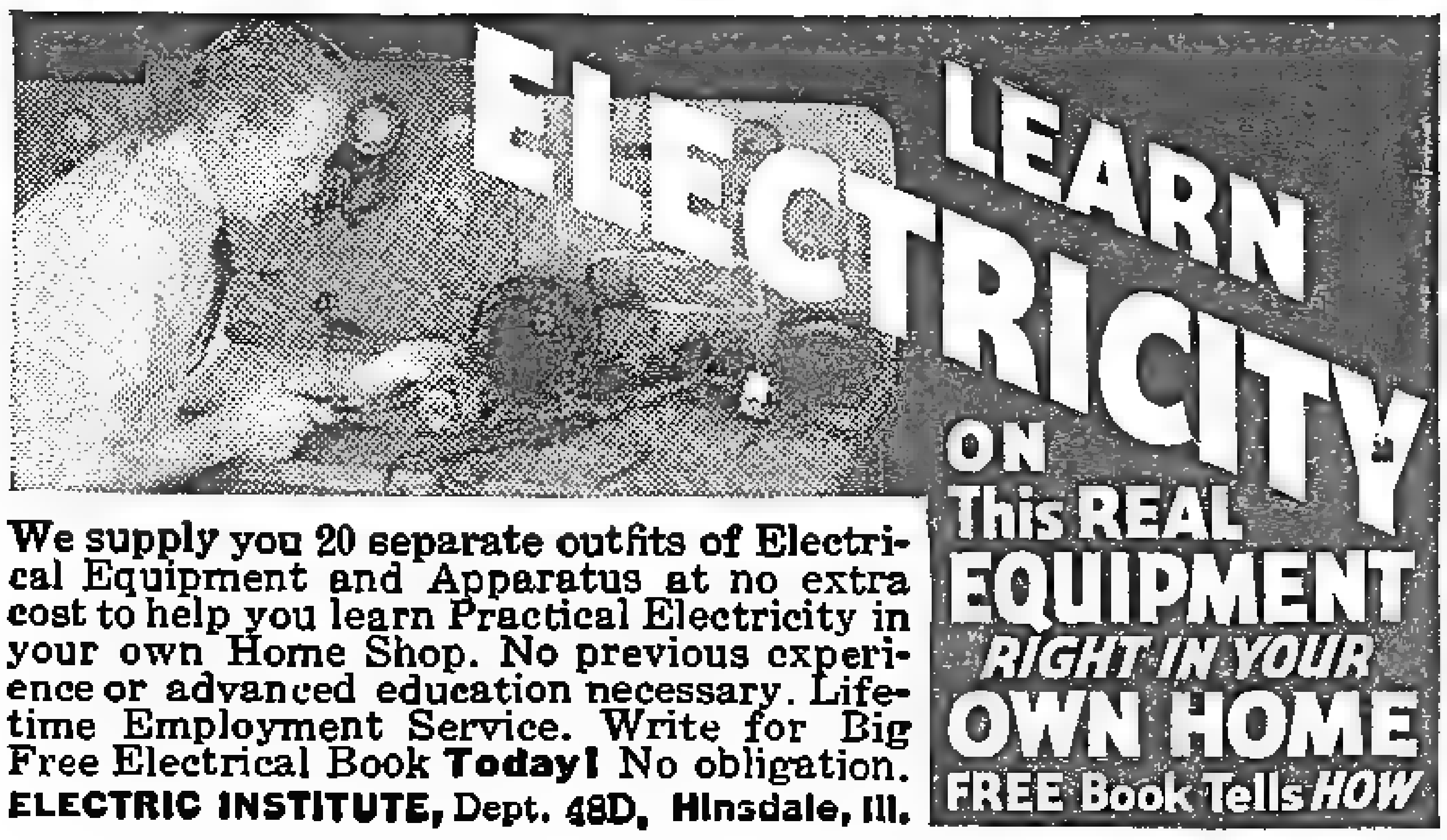
There is nothing in Sani-Flush that can injure your motor or radiator-fittings. It is a scientific powder that removes damaging dirt from the cooling system. Just pour 10c worth in the radiator. (25c for the largest trucks and tractors.) Follow directions on the can. Run the engine. Drain. Flush. Refill with clean water. Your motor will run cool. You save fuel. You don't take chances on costly repairs. You'll find Sani-Flush in most bathrooms for cleaning toilets. Sold by grocery, drug, hardware, and five-and-ten-cent stores. 25c and 10c sizes. The Hygienic Products Company, Canton, Ohio.

Sani-Flush
KEEPS RADIATORS CLEAN
Safe NOT CAUSTIC



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How To Make Enlargements

[*Continued from page* 106]

avoided if the negatives are to be enlarged. Besides, the contrasty developers are mostly also rough-grain in action; for enlarging, fine-grain developing is necessary or the pictures will look like rough sand. The popular D-76 film developer is highly recommended.

Never start immediately with a whole sheet of paper. Cut a sheet into five or six strips about an inch wide, and try test pieces first. Until you develop "timing sense," make any wild guess as to the exposure, and see how the test strips work out. The standard bromide papers start to show an image after about 20 seconds of immersion in the developer, and reach their full depth in 90.

After determining what appears to be the correct exposure time, put a whole sheet of paper on the easel, turn the red filter over the enlarger lens, snap on the light, and move the easel around to center the image properly. Turn off the light, swing the red filter out of the way, and make the exposure.

Immerse the whole print quickly in the developer and swish the latter around by tilting the tray. After about 80 seconds, pick up the wet print with the print tongs and examine it under the safelight while it drips. When it is fully developed, swing it through the acetic acid bath for about five seconds, and then transfer it to the hypo. NOW, wash the tongs in the water tray,

[*Continued on page* 138]

How To Train Your Dog

[*Continued from page* 60]

onto the other, he is placed in a sitting position. Stepping a few feet in front of him, the trainer calls the dog by name. If the dog does not respond to the order, "Come Max" the rope can be jerked gently. The dog at first does not know you have the power to pull him by tugging on the rope and he will be astonished the first time you do so. However, after three or four lessons he will realize what is expected of him. The Hollywood trainer says it is a good idea to reward the dog either with praise or a meat scrap when he has answered the command.

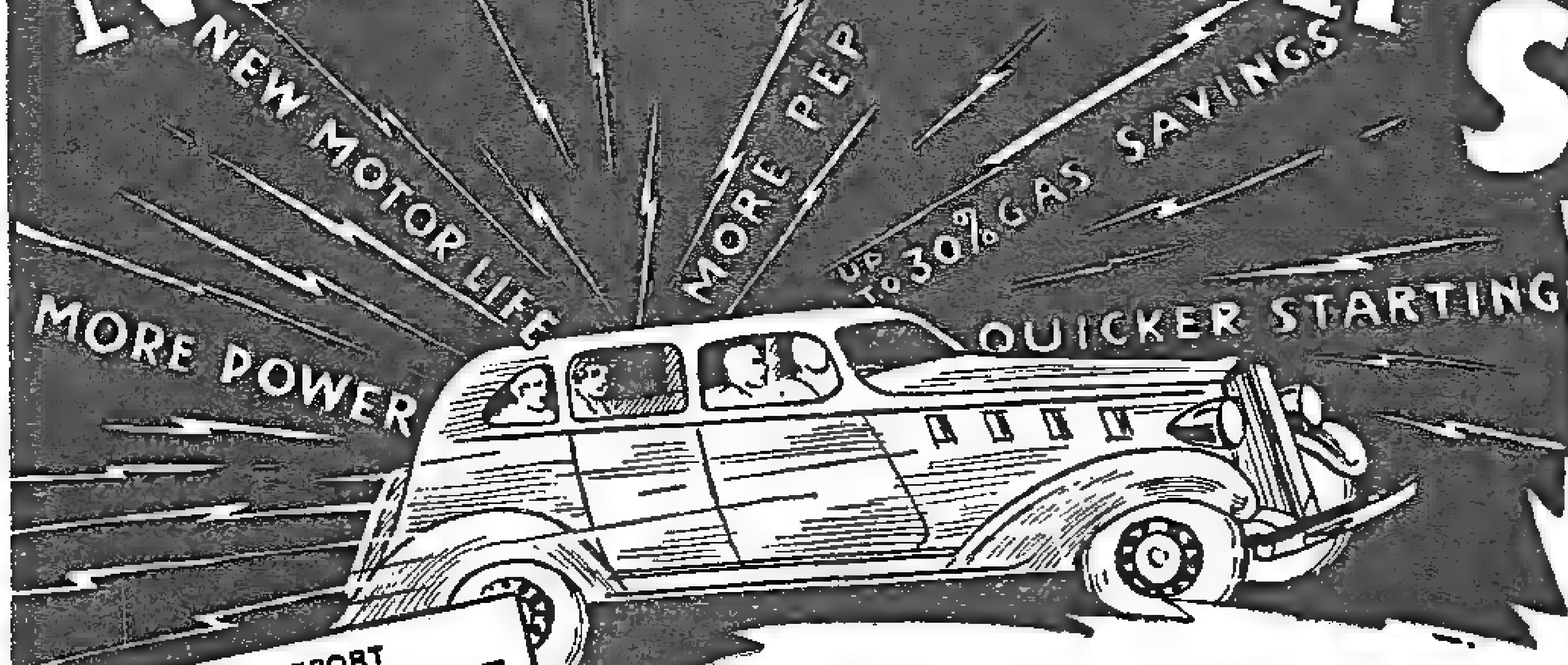
Unless you want a shy, disobedient dog, he should not be let outdoors without this long rope being attached to his collar, Spitz believes. This lesson should not be given more than five times in one day. Don't wear a dog out with training and do not try to teach him everything at once.

Walking without a leash can be conveyed to a dog in the same manner as was shown above. At the first sign of any independent spirit, however, the leash should be put back on and the dog reprimanded.

The best way to teach a dog to "heel" is to place him on a short leash and walk with him beside a high board fence. (See illustration). The dog is

[*Continued on page* 139]

New Invention WITH SUPERCHARGE PRINCIPLE SAVES GAS



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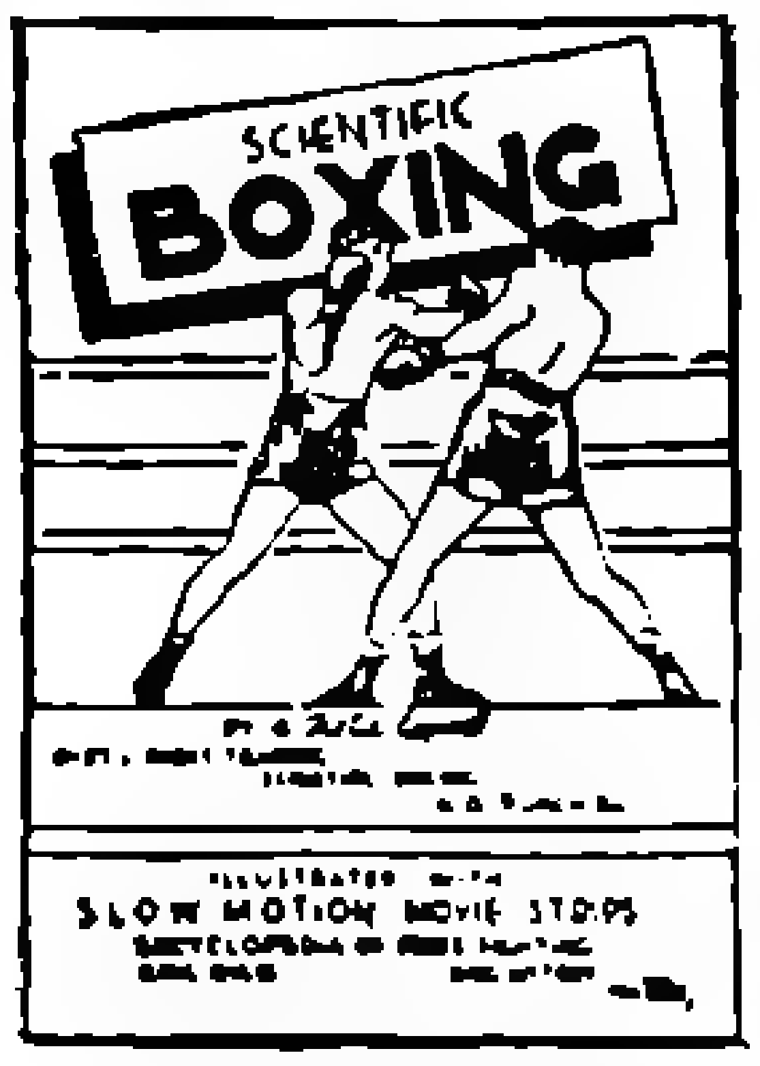

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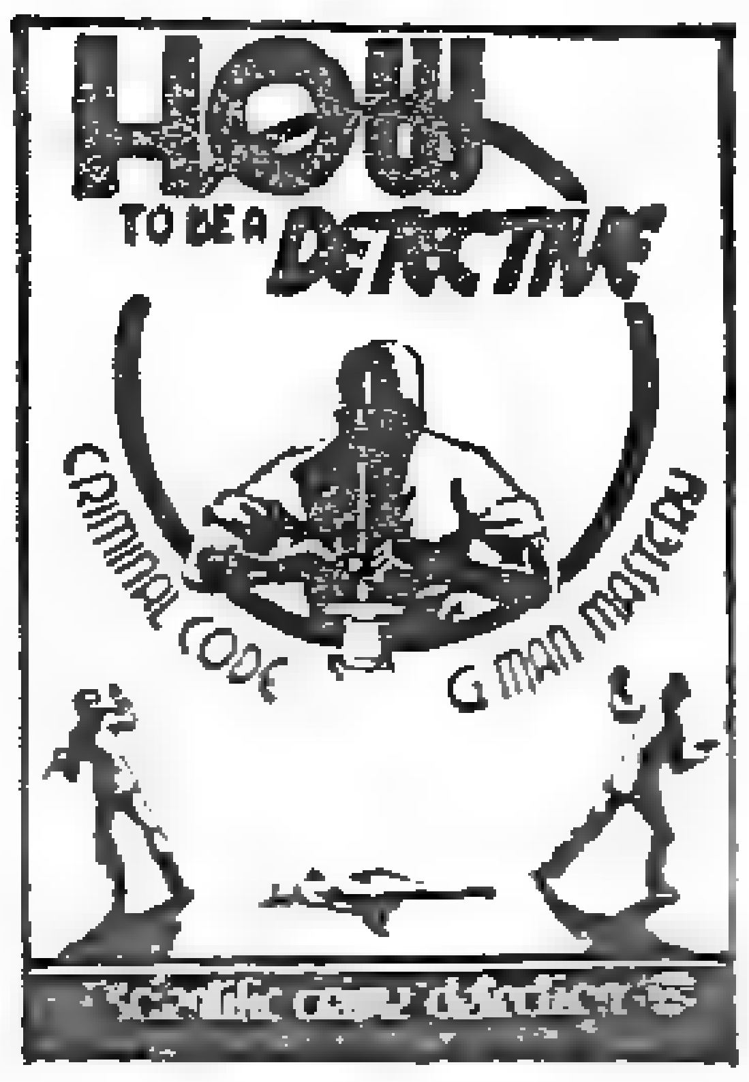

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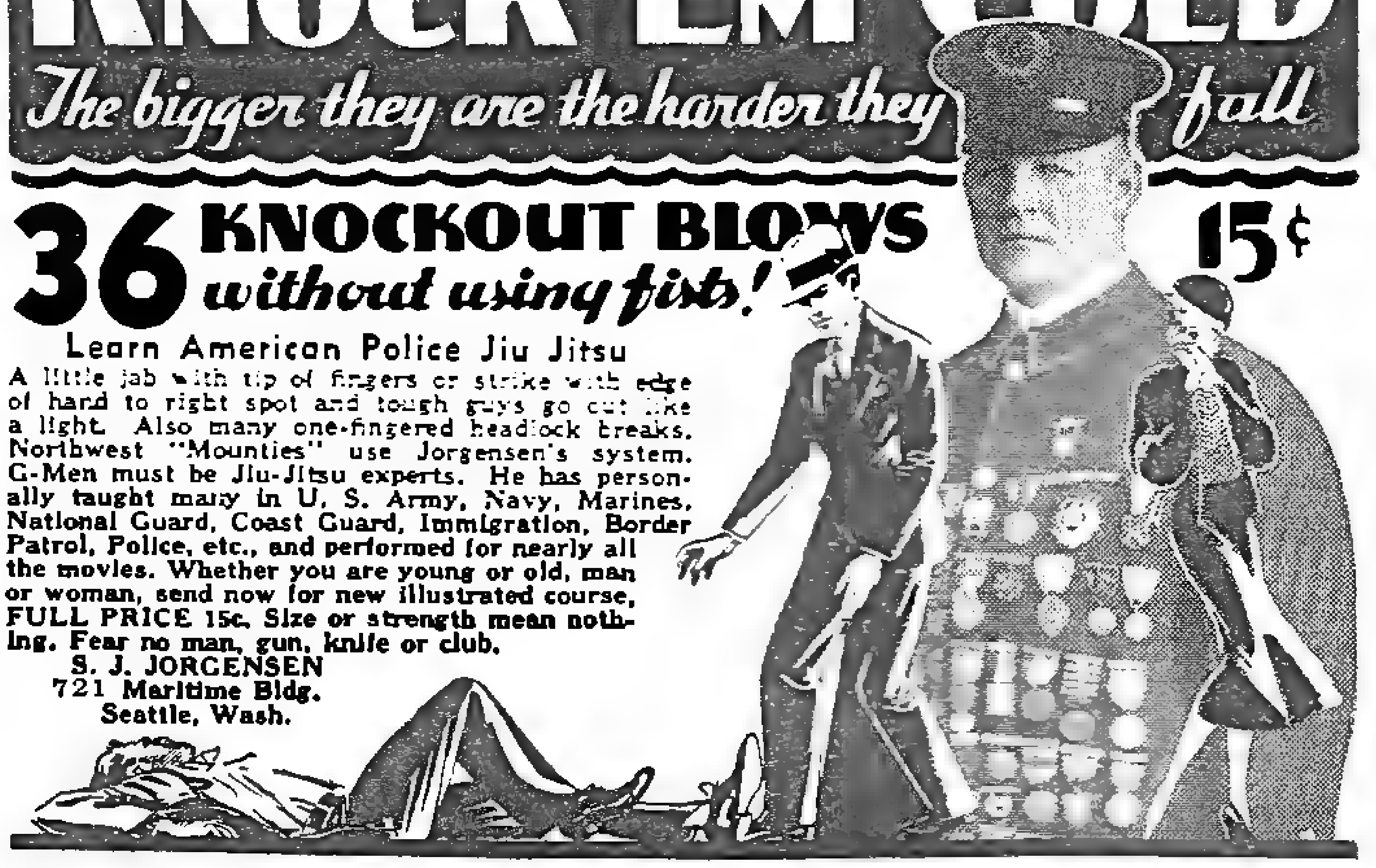

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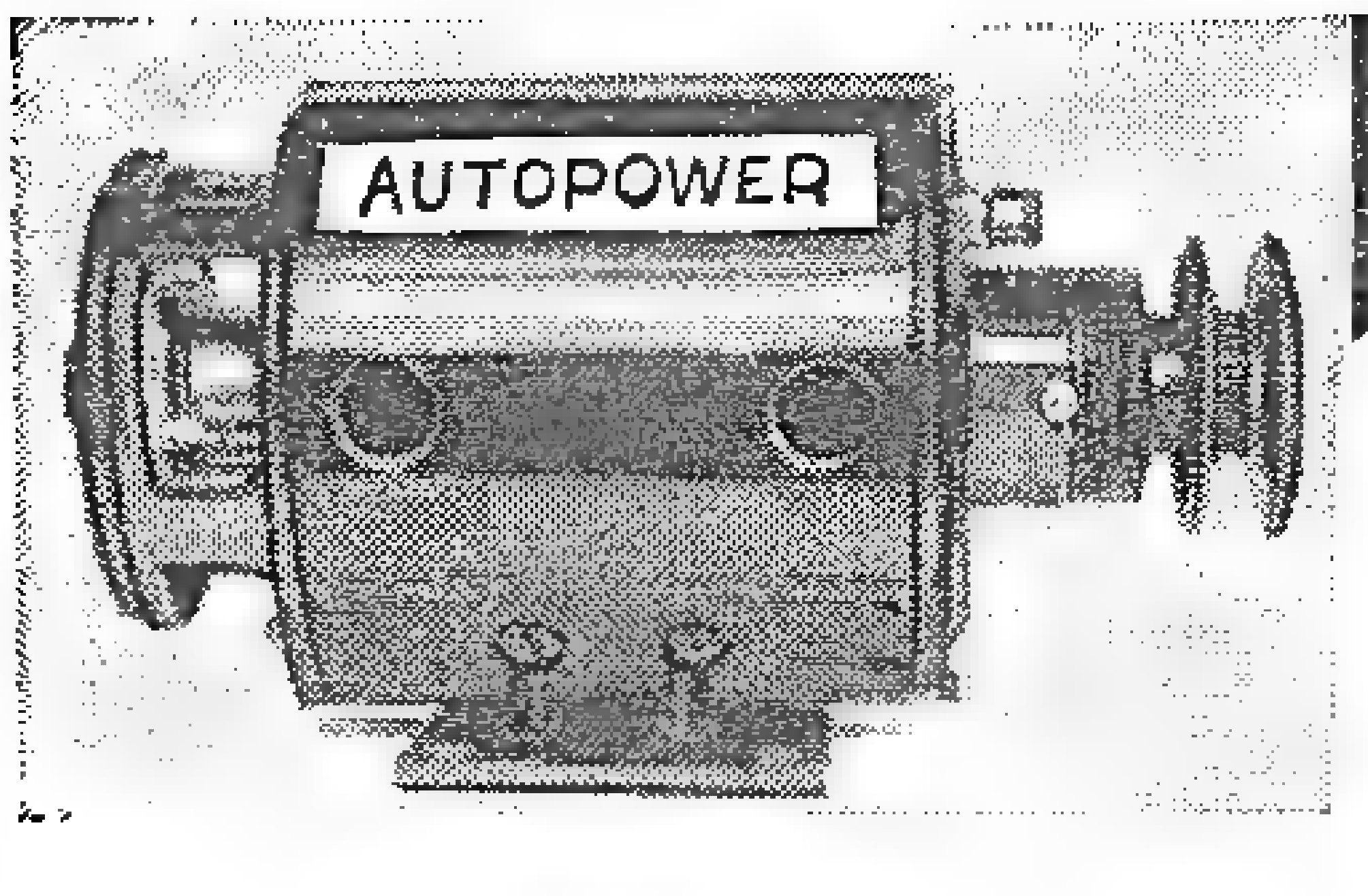

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Water Treasure Hunting

[Continued from page 44]

of cutting out, at the bottom of the well, the great pit that is to act as a filtering plant for the well, and the repacking of it with graded gravel from the top. Let Mr. Sweitzer tell of this operation, the most distinctive and valuable in deep-well creation.

"The cutting or reaming out of this pit is accomplished," says he, "with a hydraulic reamer that works under pressure in the manner employed in hydraulic mining. This reamer is made up of a series of jets and nozzles placed at the ends of direct rods in positions opposite the water-bearing strata. Water forced down from the top of this reamer spreads upward and outward from the jets at the bottom of the drilled well and washes out the formation there. The refuse is floated to the top and sluiced away.

"In the meanwhile, from another pipe, paralleling this one but not connected with it or its jets, graded gravel and water are pumped down into the pit hole from the top. This operation we call 'gravel-walling' or 'gravel-packing.' It is a new idea in deep-well construction and is designed to assure more water from the well than otherwise. From two to ten times the volume of water that is obtained from other types of wells is obtained through this new type. The hydraulic reamers work under pressure of from 100 to 200 pounds per square inch and the volume of water forced through the reamer during the excavation process is about 700 gallons per minute."

When the outer casing has been placed and the contaminating seep water from the surface cut off by running a concrete shell around it, the inner casing is put down. This inner casing is very important, for it is through this casing that the water from underground is brought to the top of the well. It has a shutter screen at the bottom through which the water enters from the gravel filters. This shutter screen extends from the bottom of the well to the top of water-bearing strata and wherever else, in the course of sinking the well, water-bearing strata is encountered.

This bronze shutter screen also represents the very latest ideas in deep-well construction. The slots in it are arranged cross-wise around the tubing so as to insure against sand-locking of the well. It is made of silicon bronze, 95 per cent copper and 5 per cent other alloys. It will not corrode, rust away or build up mineral deposits on itself. Its hardness is so great that an acetylene torch can scarcely faze it.

The forcing of concrete up the outside of the outer casing is the most particular job of all in modern deep-well construction. This is because the concrete is pure and sets so quickly that, should enough time elapse from running it that it hardens before it reaches its destination, the well is "done for."

Running this concrete shell is accomplished as follows: The outer casing of the well is put down with a wooden plug in the bottom. This plug is securely fitted in place with screws from the side of the casing. In the center of it is a "V-shaped" vent.

When the concrete is ready to be poured, a pipe is dropped down into the well with a V-shaped nozzle on the end of it that fits snugly into the V-shaped vent in the wooden plugs at the bottom. Concrete and water are now forced down this pipe under pressure. They pass through the vent and are carried back up along the outside of the casing to the top of the well. Thus a concrete shell is formed about the entire outer casing.

The purpose of this shell is to ward off seeping surface water from the pure water rising from underneath the ground. The tendency of this seepage is to trickle down the casing's outerside to the bottom of the well, contaminating the reservoir supply there. This system of protecting a deep-well water supply is now virtually required by all hospitals, cities and municipalities using deep-well water.

"There is a popular belief that rivers and streams supply the underflow of water in the earth," says Mr. Sweitzer. "This is not the case. The supply comes from rainfall. The rain percolates down through successive strata until it reaches a porous formation underlaid by an impervious one. This porous stratum thus becomes a storage reservoir.

"Another source of underground water supply is limestone. This stone is very porous and water permeates it readily. Whole areas of the United States are underlaid with this water-bearing formation. A notable section is that found around Savannah, Georgia.

"Water is also found trapped in underground rock where, through crevasses, it has seeped, remaining there until it is brought to the surface by the deep-well driller. It is also found in low, flat plains, immediately on top of granite rock beds located at depths from 35 to 4,000 feet. The water collected in a porous stratum is controlled by gravity and flows at a velocity dependent upon the inclination of the stratum and the voids or openings in the actual water-bearing material."

Interesting facts in connection with the flow of underground water have been gathered by Dr. Slichter of the United States Geological Survey. The facts relate to the Arkansas River Valley at Garden City, Kansas, and the survey showed that the average flow of underground water was eight feet in 24 hours. Using these figures and taking a river valley five miles wide with a river in the center, it would take water coming from the hills through porous strata about four and one-half years to reach the river. This computation shows how dependable and constant the underground water supply is. An average supply is always on hand.

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New Uses For Rubber Heels

[*Continued from page* 91]

any surface, use either shellac or bicycle rim cement. It is best to coat each surface with the shellac, allow it to dry, then recoat the rubber lightly and press it in place. If the use makes it desirable that the rubber have a pleasing finish, use a coating of shellac to which dry color has been added.

When the cushioning legs under your typewriter became hard from age, cut new ones from a rubber heel and notice the difference. Thin discs cemented to the bottom of table lamps, book ends and similar articles will protect the finish of the furniture; likewise, a larger block or a small-size heel under each leg of the furniture will protect the floor from becoming marred; unlike glass "gliders," they are unbreakable and non-sliding. By squaring up a heel and attaching it to a wood or metal handle, it is a practical pan scraper for kitchen use; when the edges are worn, square them with a knife. Two blocks of the material screwed side by side to the kitchen wall will hold the handle of a broom, and it can also be cut into plugs to replace worn sink stoppers when the manufactured article is not readily available.

The automobile radio will receive less vibration if it is mounted on blocks of the rubber, and small blocks make suitable replacements for the soft rubber cushions under the automobile hood clips, to eliminate noises.

Tricks With Lenses

[*Continued from page* 109]

camera lens. The easiest way to determine whether your lens is of the type that will work this way is to try it.

A jeweler's loupe, which has a focus of about 4", is very good for close-up work, particularly since its construction includes a barrel which acts as a lens-hood.

Jumping from one extreme to the other, the telephoto is the most expensive type of auxiliary lens, and one of the rarest to be found in the amateur's kit-bag. Prices run from fifty to five hundred dollars, so unless you make your living by taking wild-animal pictures in tree-tops or something of the sort, you are likely to pass this one up. You need not, however, for any field-glass may be used for the same purpose. Even the 98c ones will do, but of course these are seldom over 3 or 4-power, and hardly worth the effort. Nevertheless, there are such things as irreducible minima in photography, and the number of grains of silver as well as the resolving power of a small lens are limited by this fact. A small house a mile away might only show up as a half-dozen grains of silver with the finest camera, but when that distant landscape is divided optically by a 32-power glass, and that 32nd of the horizon enlarged to cover your whole film, you have a picture, instead of a fly-speck.

The difficulties involved here are slightly greater than in close-up work, for the reason that errors of all kinds are greatly magnified. In fact it is practically impossible to get perfect focus, but the examples shown will prove that satisfactory work can be done.

The first picture shows the Empire State Building tower taken from the writer's window with the ordinary camera lens on a typically smoky and hazy New York day. The second shows the same view, with the aid of a 98c pair of opera glasses, about 3-power. The third picture was taken with the same camera, but using one of the bargain 10-power navy telescopes now available on the market for ten or twelve dollars. Any telescope or binocular can be used in this way, and the better the instrument the shorter the exposure. A k-2 filter is practically a necessity on a hazy day. Best results are secured by removing the camera lens entirely.

The binoculars are bound to the camera with Scotch tape, with the forward end supported on books or wooden blocks. The camera stop is left wide open, the focusing done on the ground-glass, and then a piece of black paper is pasted over the front end of the large binocular lens. This has a circular hole in the center about one-fourth the diameter of the lens, thus serving as a stop and sharpening the focus and cutting out some of the color aberration. The focusing is done *before* this stop is pasted on, for there is little enough light at best. Naturally a longer exposure is needed, and absolute lack of vibration. The safest method is to hold a piece of black paper in front of the binocular lens, not touching it, then open the shutter, wait for vibration to cease, and then time the exposure with the paper.

Here again, a more permanent rig can be made by removing the lenses from the binocular and mounting them in wound kraft-paper tubes, painted black inside, with the rear tube fitting the camera lens, and the front tube sliding over the rear tube, telescopically.

Various other well-known lens tricks might be mentioned again, for the benefit of those who may not be acquainted with them. One way to increase the speed of a cheap box camera is to cut out the "diaphragm." This results in a slight haziness in the picture at all distances except one, and it usually trebles the speed of the lens. The haziness is hardly more than the equivalent of a "soft focus" effect, however, and the negatives will still stand enlargement in most cases.

Still another method of working closer with your camera, if it has a bellows extension, is to file off or bend the metal stop on the focusing scale, thus permitting the bellows to be extended beyond the usual last stop. Frequently this operation will permit you to work as close as three feet without any kind of portrait lens. If your camera has no ground-glass you will of course have to improvise one.

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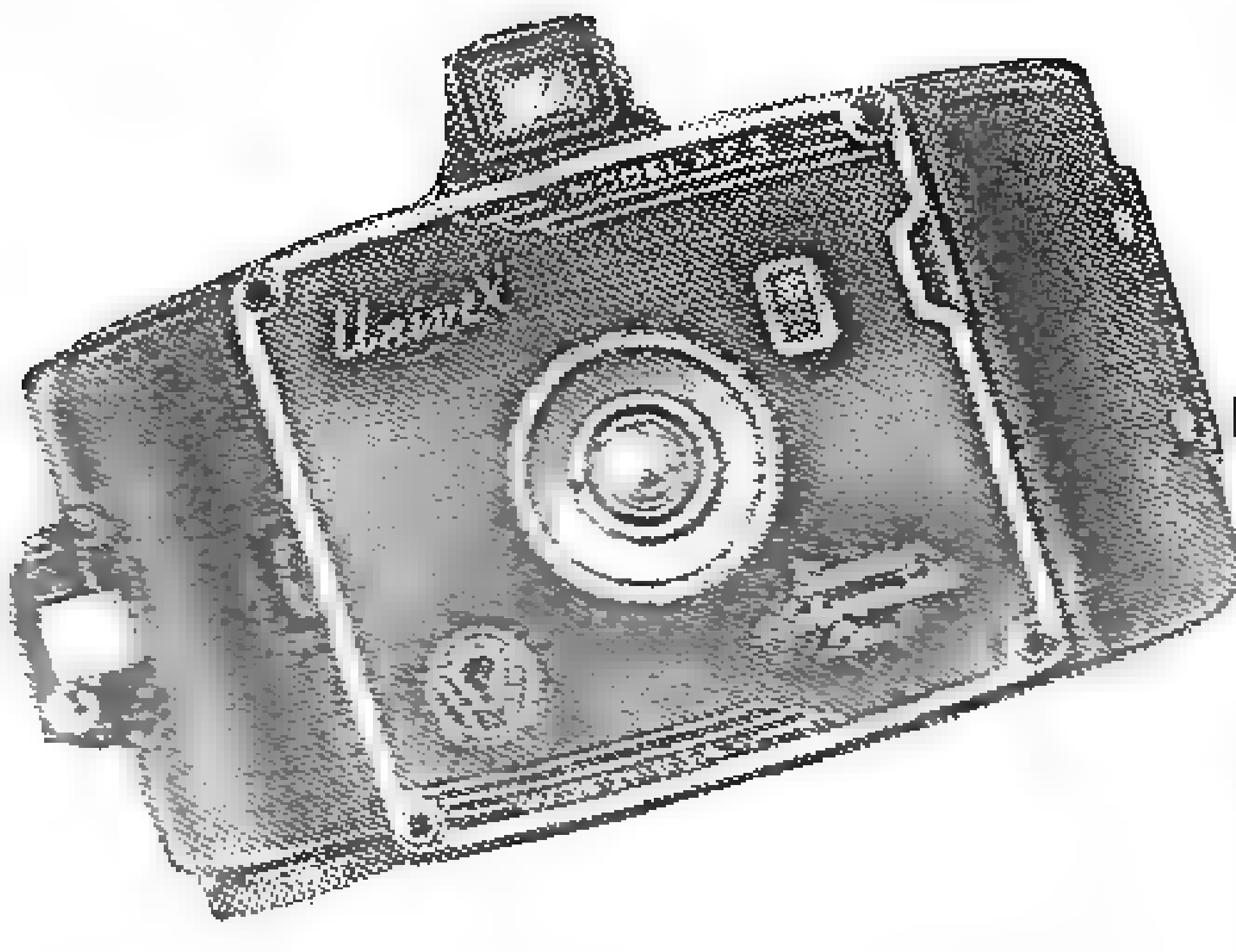

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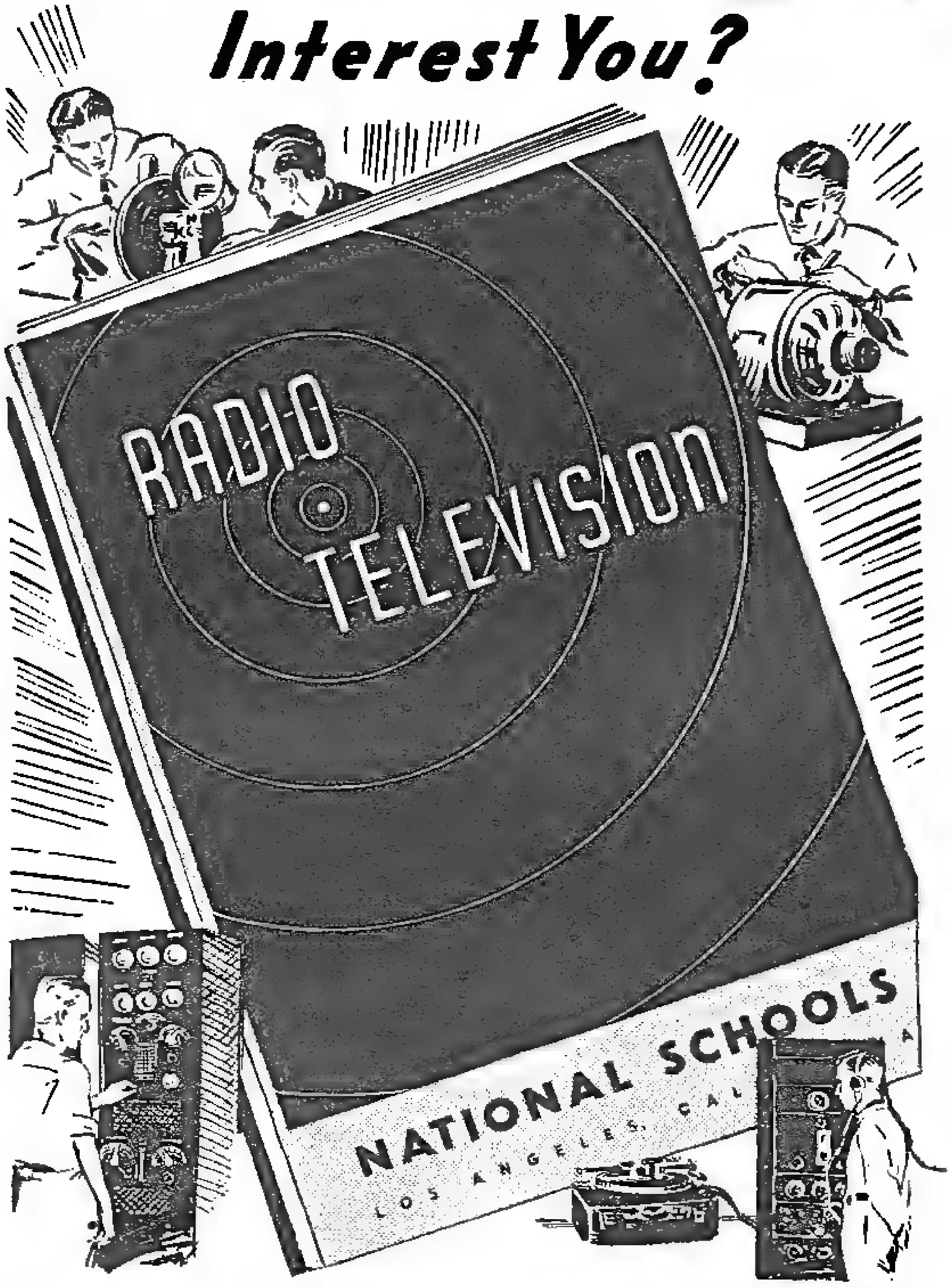

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"Color" In Black And White

[*Continued from page* 114]

To appreciate the effect shown, it is necessary to know the coloring of the three books. The left hand one has a background of bright red; the three large lines at the top are deep blue, almost purple. The emblem in the lower left corner has yellowish gold letters against deep blue. The center book is entirely maroon red, with dead black lettering. The smallest book is deep orange, with a black panel across the center. The small lines of type are black; the trade name in the center is orange like the background.

Notice in photo "A" that the orthochromatic film registered the bright red, the maroon and the orange all about the same tone of blackness. The smallest book is all dead black, and not a word on it can be distinguished. It is hard to believe that photo "B" is of the same books. The reds are now distinctly light, and the type stands out perfectly, and other differences in the "color" values are also evident.

These effects could have been exaggerated greatly through the use of filters, but this wasn't necessary. Filters prevent the passage of certain bands of light, thus giving the effect of greater emphasis to the light they do transmit to the film. The selection and use of filters is a highly interesting phase of photography, and the camera who masters their properties can produce unusual, prize-winning pictures.

Fishing For Distant Quakes

[*Continued from page* 75]

recording arm. Now prepare the stirrups at the ends of the recording arms, folding strips of aluminum as shown in Fig. 5 and punching small holes in the sides of the stirrups to accommodate the recording needles. These needles consist simply of two ordinary sewing needles run through a piece of cork at right angles, one serving as an axis while the other traces a fine line on the recording drum.

The arm is now ready to mount on the pier. Hang the weights from the two ¼-inch bolts at the top of the pier, using light, strong wire and cutting in small turnbuckles for adjustment. Now place the points of the phonograph needles in the punch marks and adjust the wires until the magnifying arms come to rest parallel to each other. This construction is clearly detailed in Fig. 6.

If the arms and weights are exactly alike they will have the same natural "period" of vibration. Set them in motion and time each one's movements, shifting the wire on the ¼-inch bolt until they have exactly the same rate of vibration. Moving the wire toward the pier lengthens the period; away from the pier, shortens it.

The recording drum, also shown in Fig. 6, is a cardboard roll 6 to 8 inches in diameter and 20 inches long and may be secured for the asking at a furniture store. Linoleum is shipped on such rolls of various sizes. A drum of these dimensions will run a week's record without renewing the record sheet.

From your neighborhood plumber, get a brass tube about 30 inches long and a brass rod that will slip snugly into the tube for a distance of 2 or 3 inches. This brass rod should be about 14 inches in length and threaded, 12 or 16 threads per inch, for a distance of 10 inches.

A square-hole washer now should be soldered in one end of the brass tube, which forms the axis for the recording drum. Mount the drum securely on this axis, leaving the 10 inches of threaded brass rod projecting from the end of the drum. The threads run in the "V" of one of the knife-edged supports made from metal strip, so the drum will move horizontally the width of one thread for each revolution of the drum. The other support, of course, carries the opposite end of the drum, as pictured in Fig. 4.

Make a square shaft which will slide smoothly in the square hole in the washer of the drum's axis. Connect one end of this square shaft to the hour shaft of the driving clock (preferably an electric or 8-day instrument so as not to stop at inopportune moments) and insert the other end in the washer.

For connecting the driving rod to the clock a universal joint of some sort must be used to allow for friction that may develop through mis-alignment or temperature changes. Fashion this universal joint by using a square washer with holes on four sides, or a small block of rubber will suffice.

The instrument may be refined somewhat by mounting the clock on a rubber-tired toy cart which moves horizontally with the drum, thus eliminating the sliding driving rod and reducing friction.

Use a sheet of wrapping paper for a recording sheet. Wrap it smoothing around the drum and glue the edges tightly. Revolve the drum slowly as you now smoke the recording sheet black by use of a coal-oil lamp minus chimney.

With recording sheet in place, carefully check over the apparatus. See that the magnifying arms are parallel; that the instrument is protected from air currents; and that the needles rest lightly on the recording drum. When everything is ship-shape, start the clock. As the drum slowly revolves a fine line will appear on the smoked record cylinder.

To make a really accurate record it is well to provide some kind of time clock. A simple scheme is to wind two tiny coils and place one on each magnifying arm in such a position that when the coil is energized by current from the light socket, it will attract the needle and lift it momentarily, leaving a minute break in the seismogram. Fig. 7 and the accompanying photos show details of magnets.

A second clock, preferably an alarm clock with a sweep-second hand, should be fitted with contacts so that each hour the contact will be made and the magnet coil energized, producing an hour mark on the drum. A small bell-ringing transformer will step down the 110 volts from the lighting service to the right voltage.

When the drum is filled with a record, remove the sheet and slip it into a trough containing shellac diluted in 50 percent alcohol, then hang it up to dry. The alcohol not only thins the shellac, but also gives a dull finish to the record and protects it against blurring.

Don't expect immediate results—you may register a quake five minutes after starting the instrument, or you may have to wait several days. But on the average, there is a distinct earthquake somewhere on this earth once every hour and some of them will register on the recording drum.

When studying your first seismogram, note that the waves seem to come in bunches. That is because each quake consists of at least three distinct groups of shocks—a primary wave, a secondary wave following a little later, and a long succession of minor shocks. The spreading of the waves as they travel through the earth's crust gradually separates these groups, and for a quake 8000 miles away, they may be as far as twenty seconds apart. By noting the time between these wave groups you may form a rough idea of how far away the shock originated.

In the study of seismograms you will doubtless find of interest two booklets that can be bought from the Superintendent of Documents, Government Printing Office, Washington, D. C. The first is a 61-page booklet with a map of the U. S. and is entitled, "Earthquake History of the U. S., Exclusive of the Pacific Region"—Special Publication No. 149, and costs 15 cents. The other, "Destructive and Near Destructive Earthquakes in California and Western Nevada, 1796 to 1933,"—Special Publication No. 191—is priced at 5 cents and is a 24-page booklet.

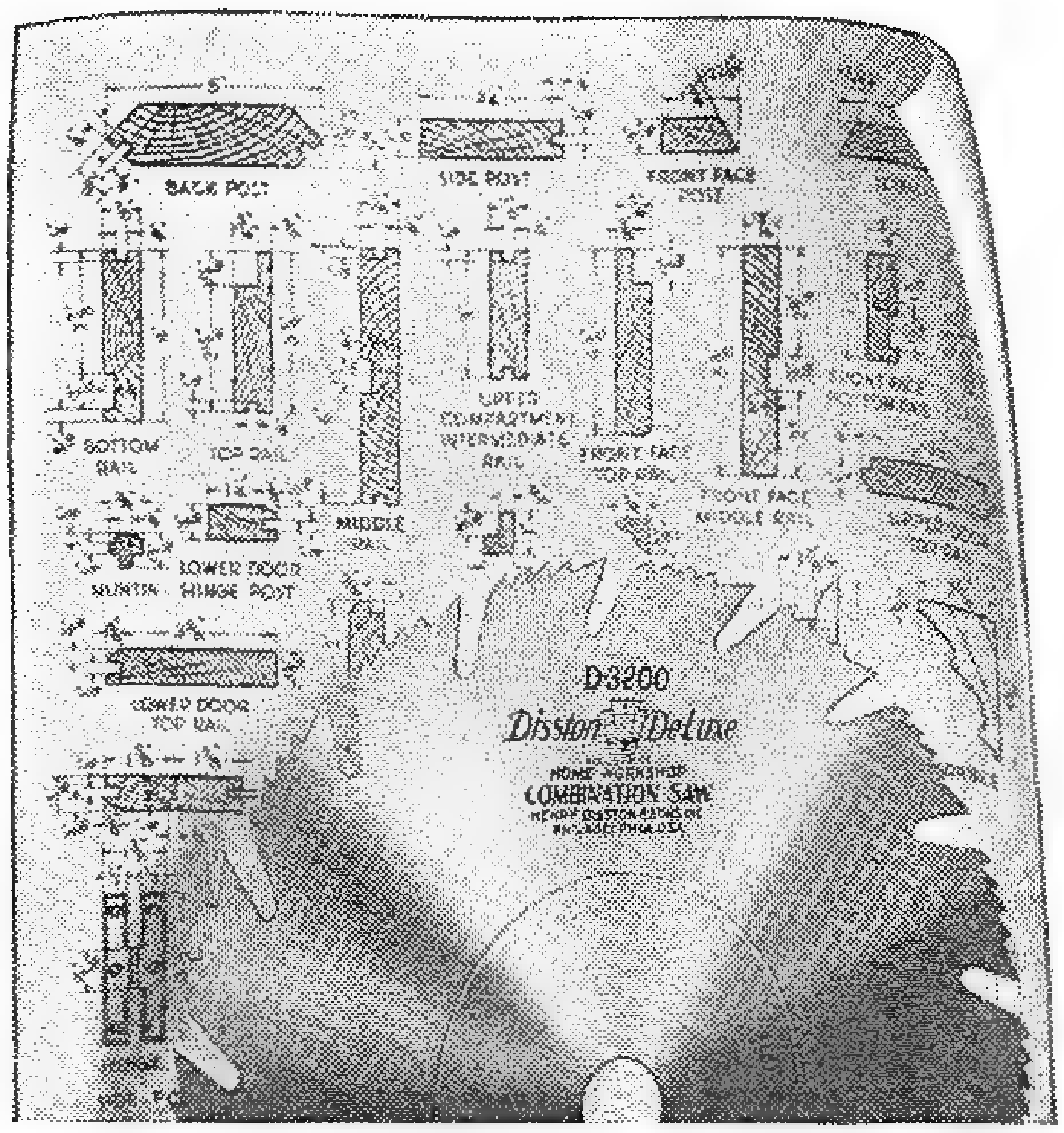
Funnel On Lock Guides Key

No more fumbling for the key-hole in the dark! For Ralph A. Ringseis of San Francisco, Calif., has just been granted a patent for a key-hole guide which unerringly sends the key on the first try into the key-hole no matter how dark it is.

The guide is a key-hole-finder de luxe. It amounts to a funnel that clamps on to the lock. The funnel has a big mouth, so that any lunge you make with the key is bound to land the key in the funnel. After that it's simple. The funnel just guides the key—and in the proper position, too —right into the key-hole.

Mineral wool is favored by many architects for insulating houses against heat and cold, but it is too bulky to be transported far by rail economically.

Television cameras, to be tried in England, are several times more sensitive than those previously used.



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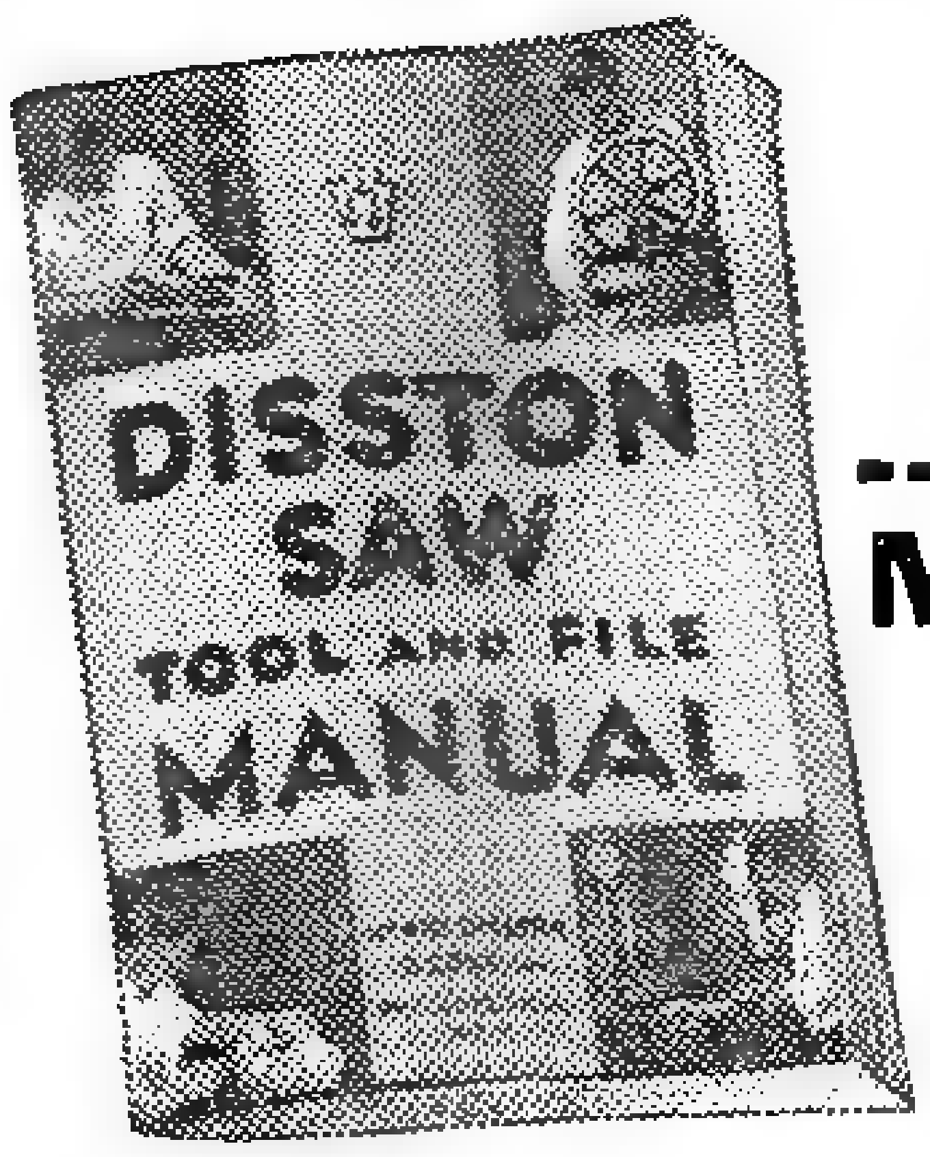

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The Flood Of New Stamps

[*Continued from page* 70]

1937 issued a series for Pushkin's centenary, six stamps in the perforated series. Only two designs were used on the six stamps. Thus the "type collector" saves but two stamps; the two designs are shown, which are sufficient. The other values merely repeat the designs, or types, and in this sort of collecting are unessential.

"Type collecting" has taken hold these days, of innumerable new stamp collectors. It is one of the most satisfactory ways of collecting, because we may have every type without every value of stamps. Therefore the cost is materially lessened. Also, an album does not become so bulky.

Of course, when an issue appears and all the designs are different, it is necessary to retain every value. In the general collection, following the "type method" the expense will be found materially decreased, and the stamp deluge immeasurably lessened.

Follow The Fleet

[*Continued from page* 118]

this relation between the two items of car expense which are so often misunderstood.

Fleet operators suggest to the car owner the importance of aiming for hidden savings. Keeping the oil filter in working order, for instance, not only saves more frequent oil changes, but lessens the tendency toward sticky valves. This, in turn checks lowered gas mileage. Keeping the shock absorbers well filled with the right kind of fluid will not only save the springs but, by controlling the bobbing action of the car, will save extra wear on the front tires. Often a little service on the generator will go a long way toward sparing the battery overcharge or discharge.

Service stations will give the owner a great deal of consideration if they find that he is taking his car management seriously. Tire companies often will rotate tires without charge, if the customer is aiming for better mileage. It is naturally good business for the company to point to examples of high mileage with its products. Such tire changes should be counter-clockwise, and the spare or spares always should be worked into the picture. Pressure is very important. Today, most tires are wearing prematurely along the edges of their treads as a result of under inflation. Inflate the tires at least once a week. Every two weeks is not often enough.

Take into consideration where the car is to be used, and vary pressure accordingly. Tires need more air around the city, especially if the car is parked for long periods.

Follow the fleet for genuine savings in motoring. If you know someone whose car is owned by a large firm, follow him to the service station and get acquainted with the system he follows.

Pocket Electro Plating Outfit

[*Continued from page* 120]

probably an indication that the distance between the work and the carbon rod of the electrode is too far. Some of the cotton can be removed from the electrode and a longer carbon rod used. The resistance can also be overcome by wiring the batteries to deliver 3 volts. Do not use too high a voltage, however, as the plating would then have a dark or "burned" appearance.

In order to make the polishing cloth, moisten a strip of flannel with benzine and rub it well with a piece of jeweler's rouge. The mercury solution is merely a saturated solution of mercury nitrate in distilled water. All three bottles should of course be marked "poison."

To make up the gold and silver electrolytes, first make a stock solution of 160 grains of yellow prussiate of potash and 80 grains of sodium carbonate in 8 ounces of distilled water. In 4 ounces of this dissolve 40 grains of silver nitrate, and add 4 grains of gold chloride to the other 4 ounces. Place each in separate test tubes or beakers and bring them to a boil over a bunsen burner. On cooling, the precipitates will have settled and you can pour off the clear gold and silver solutions. Half-fill the 1-ounce bottles, and store the remainder for replenishing purposes.

Documentary Evidence

[*Continued from page* 122]

capital E. Place a dot above the first upstroke of the letter n, making it an i; connect the top of the second upstroke of the n with a curved line over to the top of the e, then continue from the e downward with a loop to make the e into a g. The "One" has now become "Eig." Add "ht," and "One Hundred" now reads "Eight hundred." The corresponding numerals on the right side of a check are similarly altered, "100" being made "800" by simply connecting top and bottom of the "1" with an S-shaped loop. Experts can do this sort of thing so that it will escape detection by the unaided eye, but the microscope will show up the added work by the same principles as explained above under forgery.

There are a great many different brands of ink on the market, the blue tint predominating. While many of these different inks appear to have exactly the same hue to the eye, a comparison microscope will quickly disclose even slight variations in tint, and the same principles apply in comparing the inks of typewriter ribbons as seen in typed material. This constitutes another way of detecting checks raised by the method of addition, as very often the new ink will not exactly match the original.

The comparison microscope has two tubes, each with its own objective, but only a single eyepiece, the two images being directed by prisms so that

[*Continued on page* 135]

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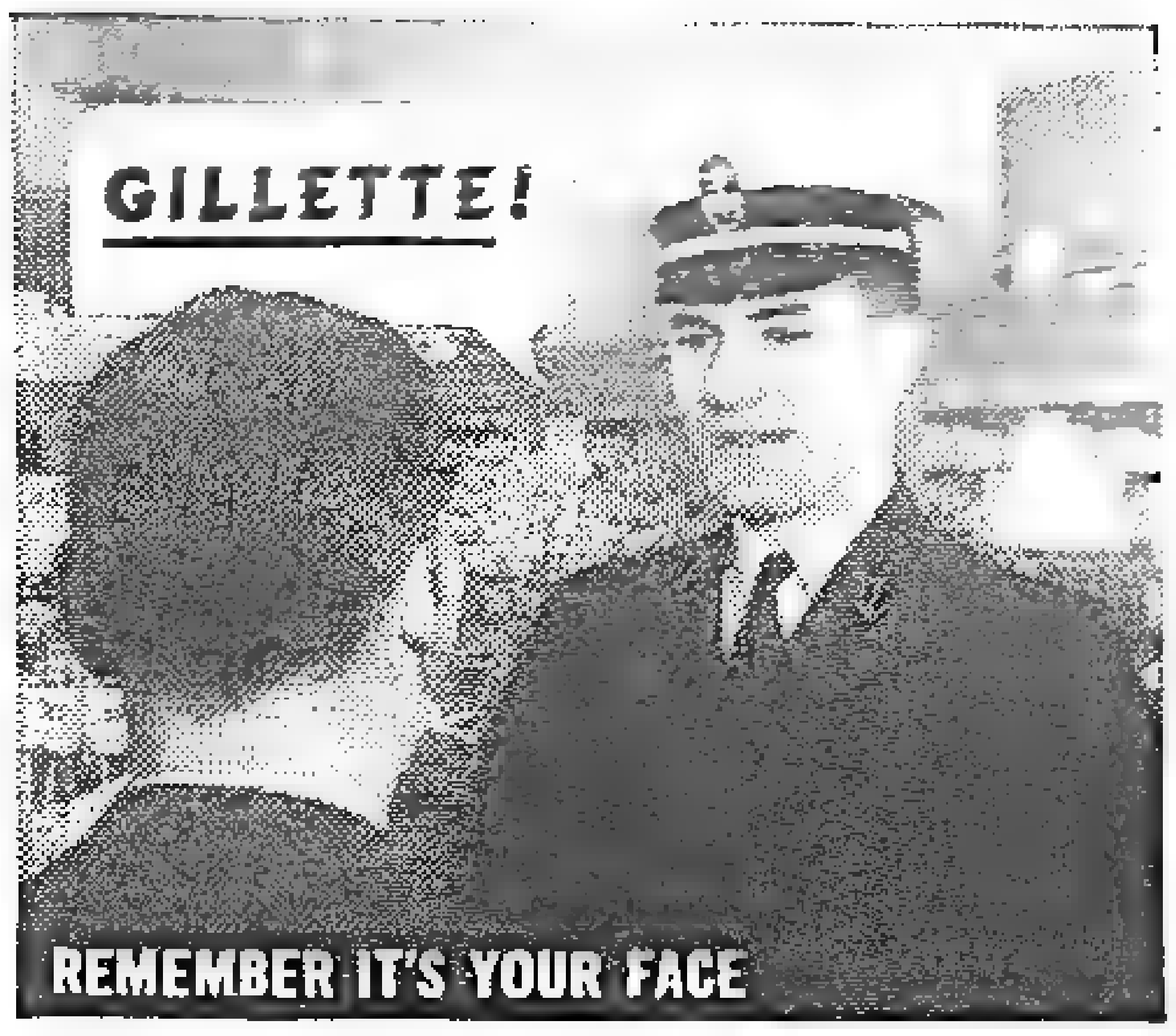

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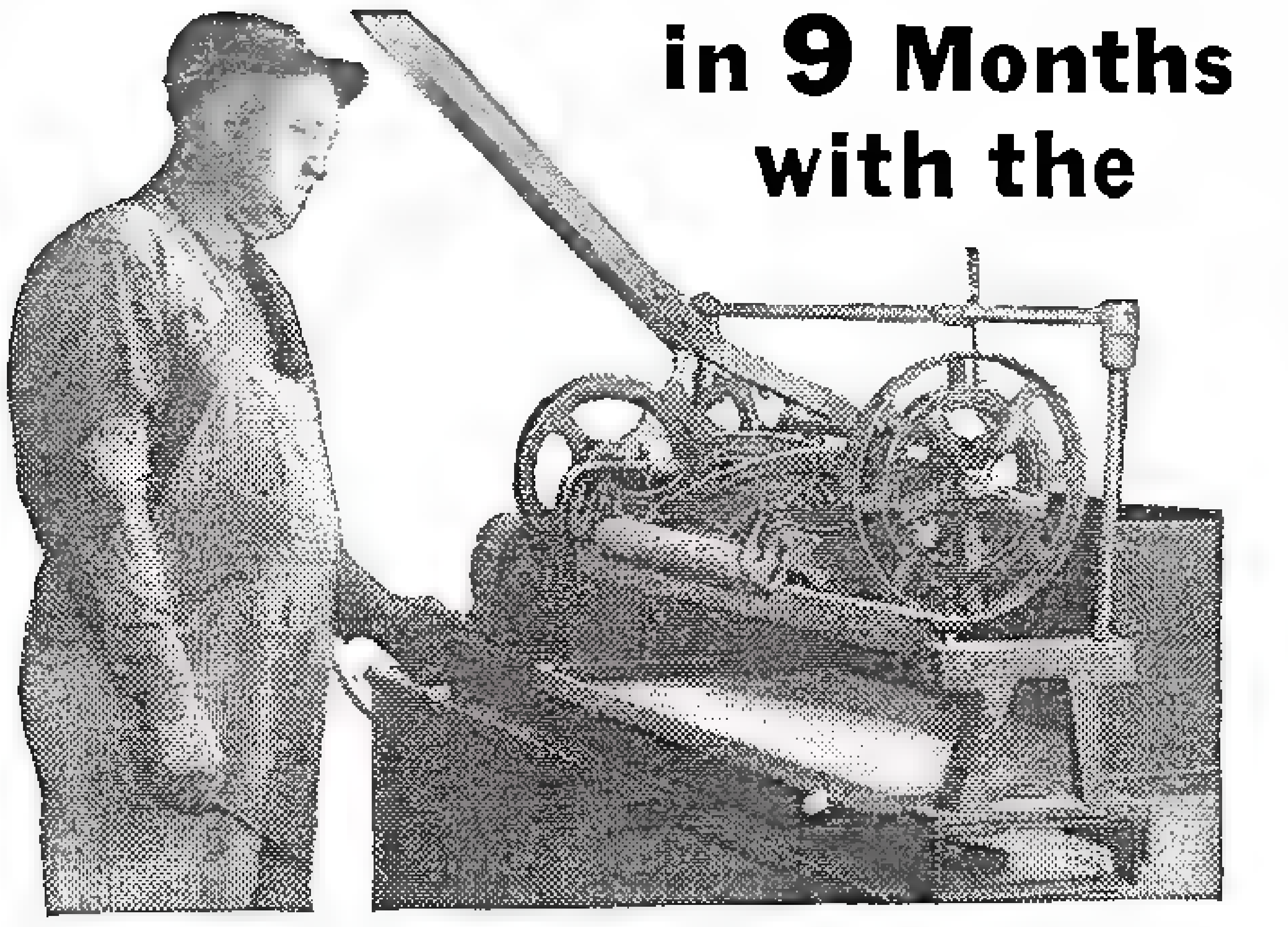

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Trick Drawings From Photos

[*Continued from page* 107]

The most important requirement is that the print be on smooth or semi-matte paper. Glossy paper is absolutely unsuited for the stunt. Pin the print to a drawing board, and use ordinary drafting or art instruments. The ink can be of any color, as long as it is the waterproof kind. Simply ink in whatever you want to remain in the picture, or add lines wherever desirable. Use T-squares, triangles, French curves, compasses, brushes, etc., as aids. You can even do good work with an ordinary fountain pen.

Be careful to let each line dry before you run the T-square or triangle over it. If you attempt to make erasures, you are likely to remove the thin layer of emulsion that constitutes the picture image.

Use as many different colors of ink as you like. However, if you are preparing an illustration for reproduction for printing purposes, use black only.

Two chemical solutions are required. The first is for bleaching, the second for fixing. The bleaching bath consists of the following:

Iodine crystals (NOT tincture of iodine sold for antiseptic purposes)—60 grains or 7¾ gm.

Potassium iodide—180 grains or 23¼ gm.

Cold water—20 oz. or 592 ml.

Iodine crystals are sold in small glass-stoppered bottles. Don't let any of it touch your fingers. The mixture becomes deep red in color with the addition of the potassium iodide, and must be stirred thoroughly with a glass rod until all the crystals have dissolved. A quart bottle is handy as a container.

The fixing bath consists merely of 4 oz. or 113.4 gm. of ordinary photographic hypo in 20 oz. or 592 ml. of cold water.

Pour the solutions into two trays. Immerse the inked-in print in the iodine bath and keep it there for about two minutes. The entire image will appear to be blotted out with red, but don't be alarmed. Pull out the print with a pair of tongs, let it drain for a second or two, and then immerse it in the hypo tray. In about a minute the red tone will fade out, and in about five minutes the photographic image will disappear completely. All that will remain will be the inked lines, appearing against a perfectly white background.

Let the print "fix" in the hypo for about fifteen minutes. Then wash it in running water for about 30 minutes, and dry between blotters just as with regular photo prints.

This entire "silver printing" process is carried out in full room illumination. No darkroom is necessary.

NOTICE

Changes in the make-up and title of this magazine, designed to make your favorite publication better than ever before, will be announced in our next issue. Be sure and reserve your copy now.

Documentary Evidence

[*Continued from page* 133]

they make up halves of a single field of view, divided by a hairline. Not only ink colors but many other forms of documentary evidence are directly compared by means of this ingenious instrument, a modification of which, used in studying bullet scratches, appears in one of our photographs with this article. Specimens of hand or typewriting, pen and pencil points and slants, type faces, paper surfaces, erasures, added material in the form of interlineations or overwriting—these are but examples from a long list which are but grist to this microscope.

Operating on a similar principle, the colorimeter is an optical instrument borrowed by criminologists from biochemical laboratories. It has two cups in which liquids can be placed for a direct optical comparison of a known with an unknown solution.

The fluorescence microscope is yet another weapon in society's war on the criminal. This machine employs lenses and prisms of quartz, which will transmit ultraviolet light to be recorded photographically, though such rays are invisible to the human eye. They cause substances to glow or fluoresce with hues that are characteristic for different kinds of materials and may be extremely valuable in identifications. As an example, there was a case where it was alleged that notations on a certain document were written in 1868, but when the red ink under dispute was examined by the fluorescence microscope it was proved to be made from the synthetic dye eosin, which was not discovered until 1874.

When the microscope is put to work on a simple piece of typewriting, as an anonymous poison-pen letter or demand for blackmail. it is seen that every typewriter has its own distinctive peculiarities and that the product of one may be told from that of another just as surely as the experienced operative can distinguish between two different fingerprints or sets of bullet scratches.

Marks and imperfections on type faces, smudges from unclean and clogged characters, deviations in slant from the perfectly vertical, minute divergencies from a theoretically perfect horizontal alignment, slight discrepancies in spacings, letters which do not strike the platen evenly but are instead heavier in one portion than another—these examples will give an idea why it is easy, under magnification, to identify a specified piece of work with the machine that wrote it.

The police consider all possible suspects in a case and the proposition is then to "cherchez la typewriter" instead of "la femme!" Samples are taken from every machine to which any of the suspects could have had access, and compared with the criminal document, with certainty of identification. Working back then from the typewriter, an arrest most often follows.

[*Continued on page* 137]

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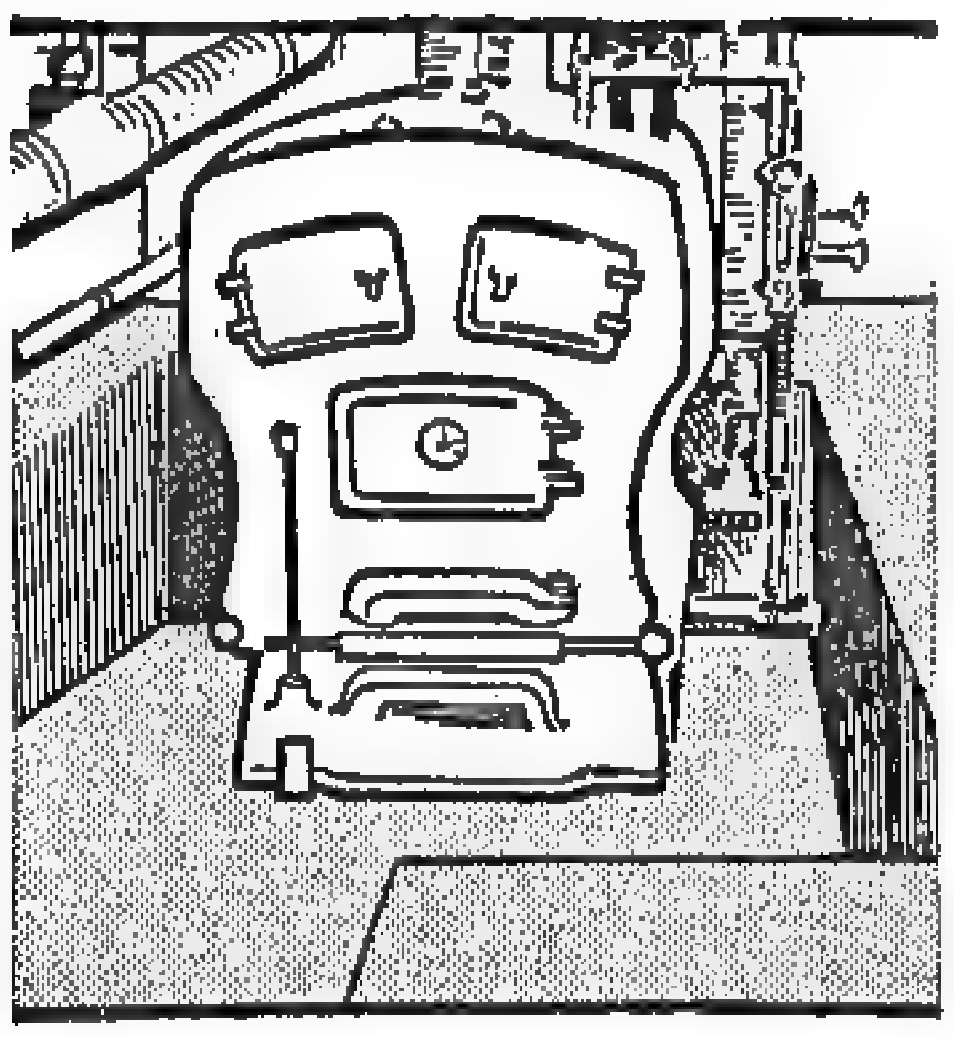

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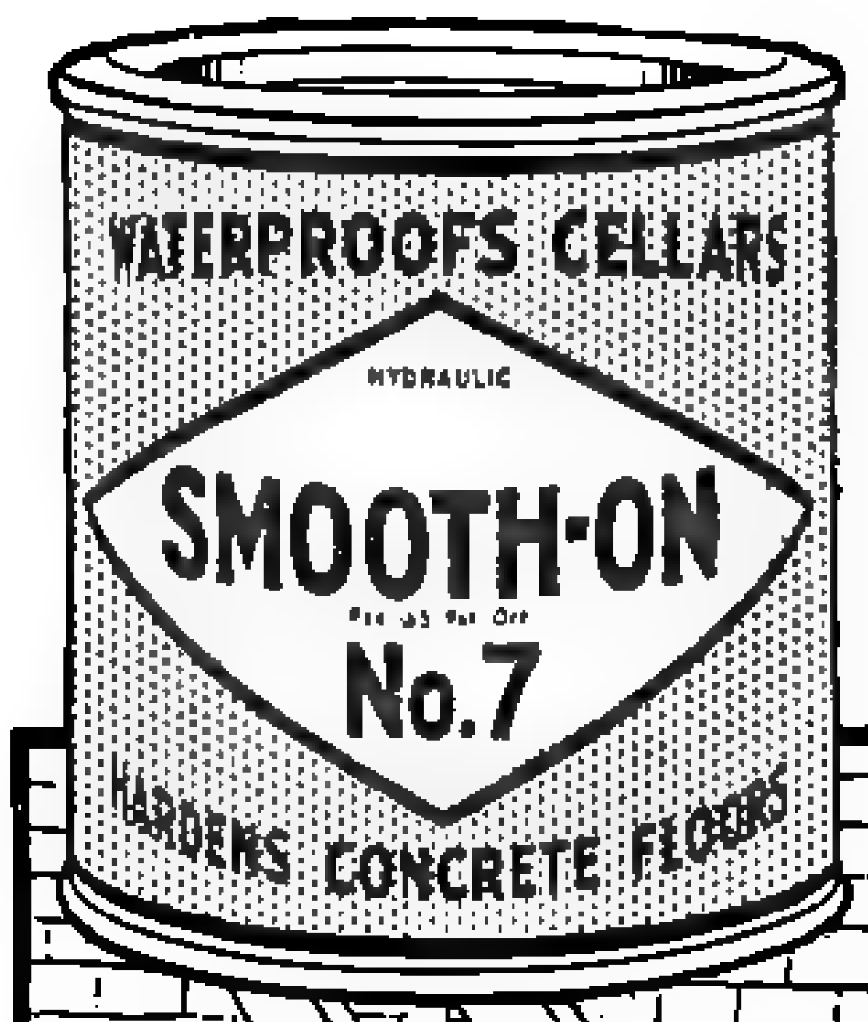

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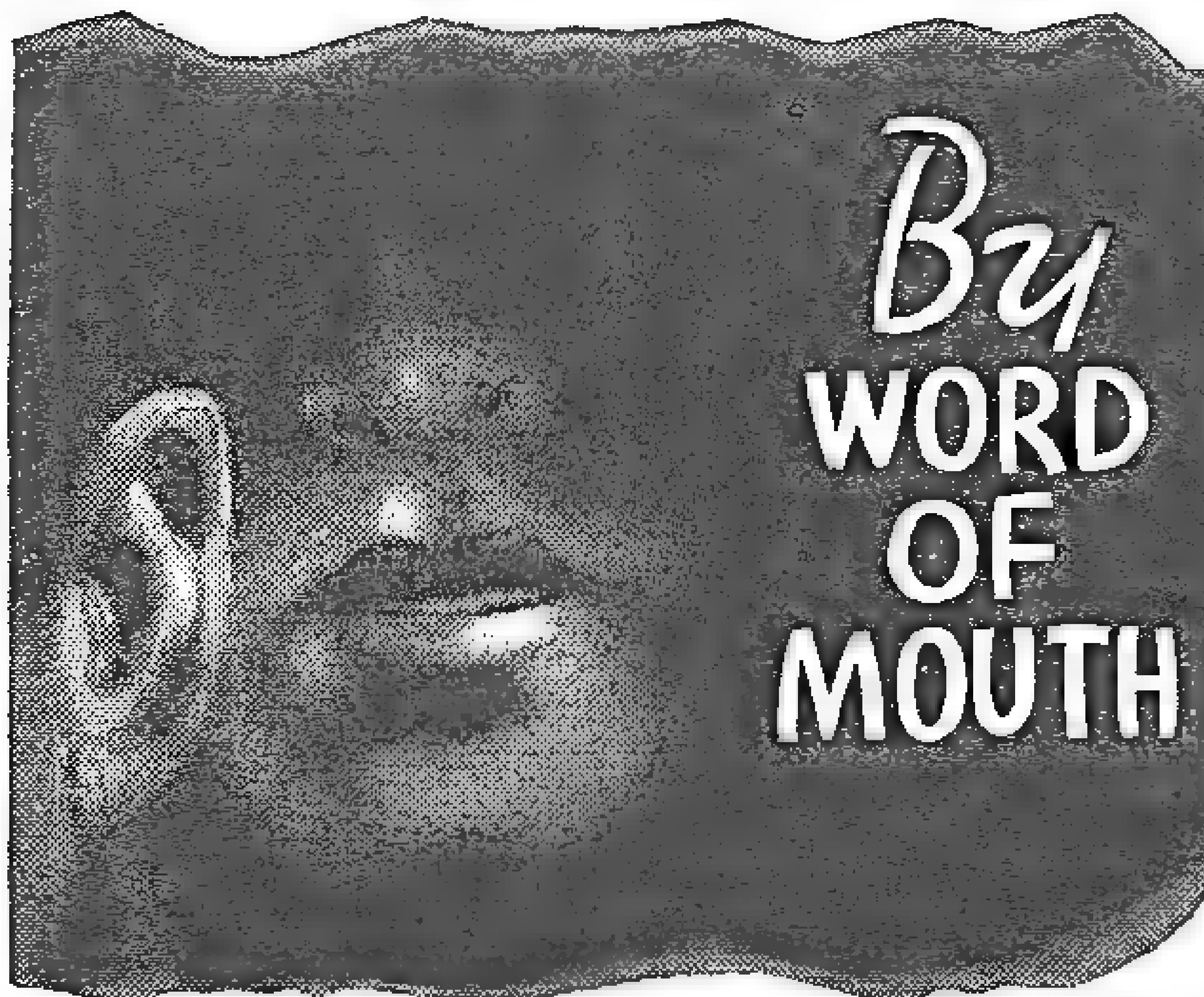

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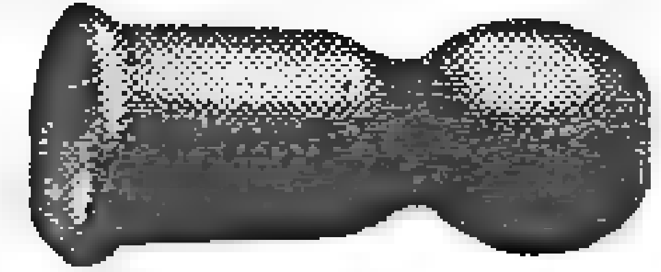

Artificial Ear Drum

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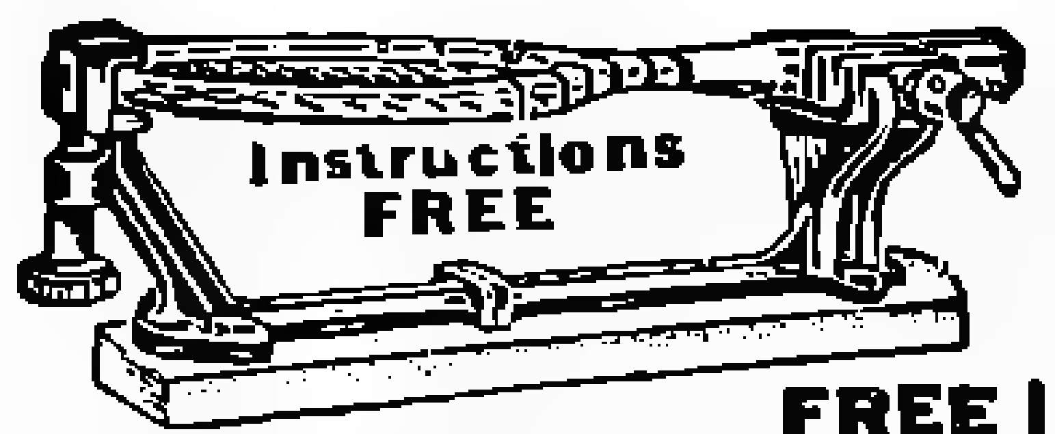

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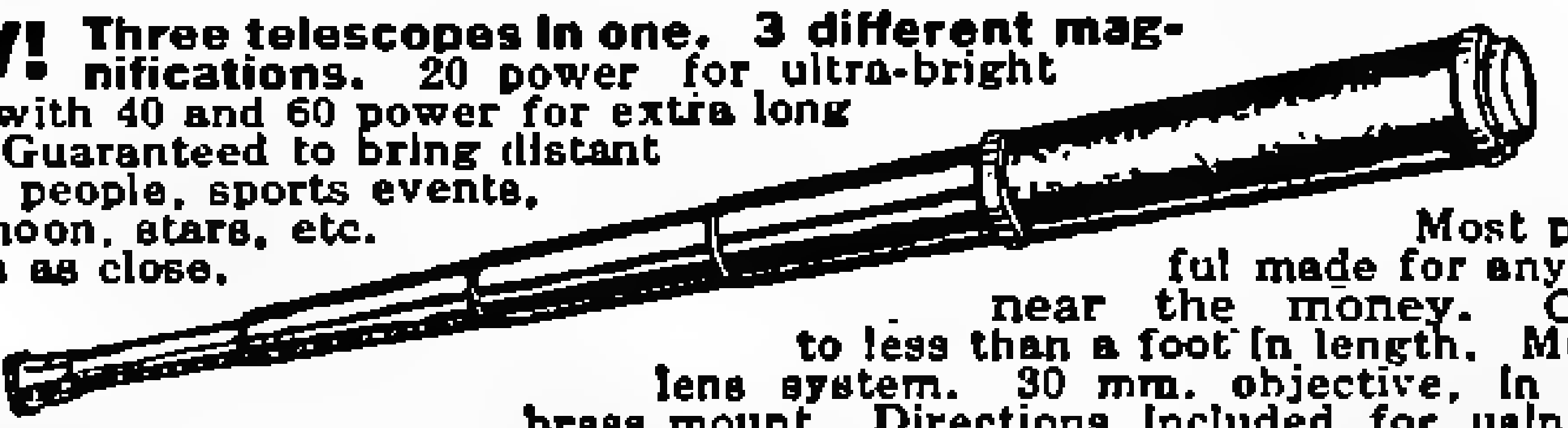

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Documentary Evidence

[*Continued from page* 135]

This project can be worked with ease as an exercise in evaluating evidence. Have various friends copy the same material upon separate cards, using as many different typewriters as can be pressed into service, marking their contributions with code numbers. The cards are shuffled and one is handed to you to represent a blackmail note. First study the characteristics of this specimen thoroughly, then endeavor to secure samples of all the machines that you can associate with these friends. After making comparative studies you finally pronounce your verdict as to the guilty party. This can be made into a thrilling game among a group who own microscopes or as a club program, perhaps even offering a prize to the one who solves a given problem most rapidly, or who makes the best score in a series of puzzlers.

Low magnification, up to 20X, is best for this work and the binocular microscope much the best of all.

While spurious coins or bills are not available for comparison with real ones, the points involved may be explained. Examine a dollar bill carefully under low magnification and see how many separate items you can pick out as to composition of the special paper used in printing banknotes. The engraving itself is exceedingly intricate, but even granting that what the skill of one man can produce, the ingenuity of another can reproduce, the counterfeiter cannot have access to the correct paper and inks, the ingredients and manufacture of which are closely guarded secrets. Nor can he make a plate so exactly like the original as to defy detection under a comparison microscope.

Note the elaborateness of the engraved design and instances of overprinting in separate colors. See the colored threads in the paper—reds and greens and blues, not visible without magnification, and the very fine grain and composition of the paper itself. Those trained in looking for definite features with a lens can quickly pronounce a given bill as genuine or otherwise.

Examination of coins is similar. It is impossible for two dies to be exactly alike in all microscopic detail, no matter how clever the workman. Stamps too are carefully executed. Paste a postage stamp on a blank slide, add xylol, cover and study by transmitted light; mount another one dry and examine by reflected light. These observations will make clear how Uncle Sam safeguards the paper, ink and workmanship of all replicas having monetary value.

The binocular and comparison microscopes are of greatest service in work on spurious moneys, with the colorimeter or fluorescence microscope also occasionally asked for a verdict. The microscope, like that hero of our small boys, Dan Dunn, preaches that *crime never pays!*

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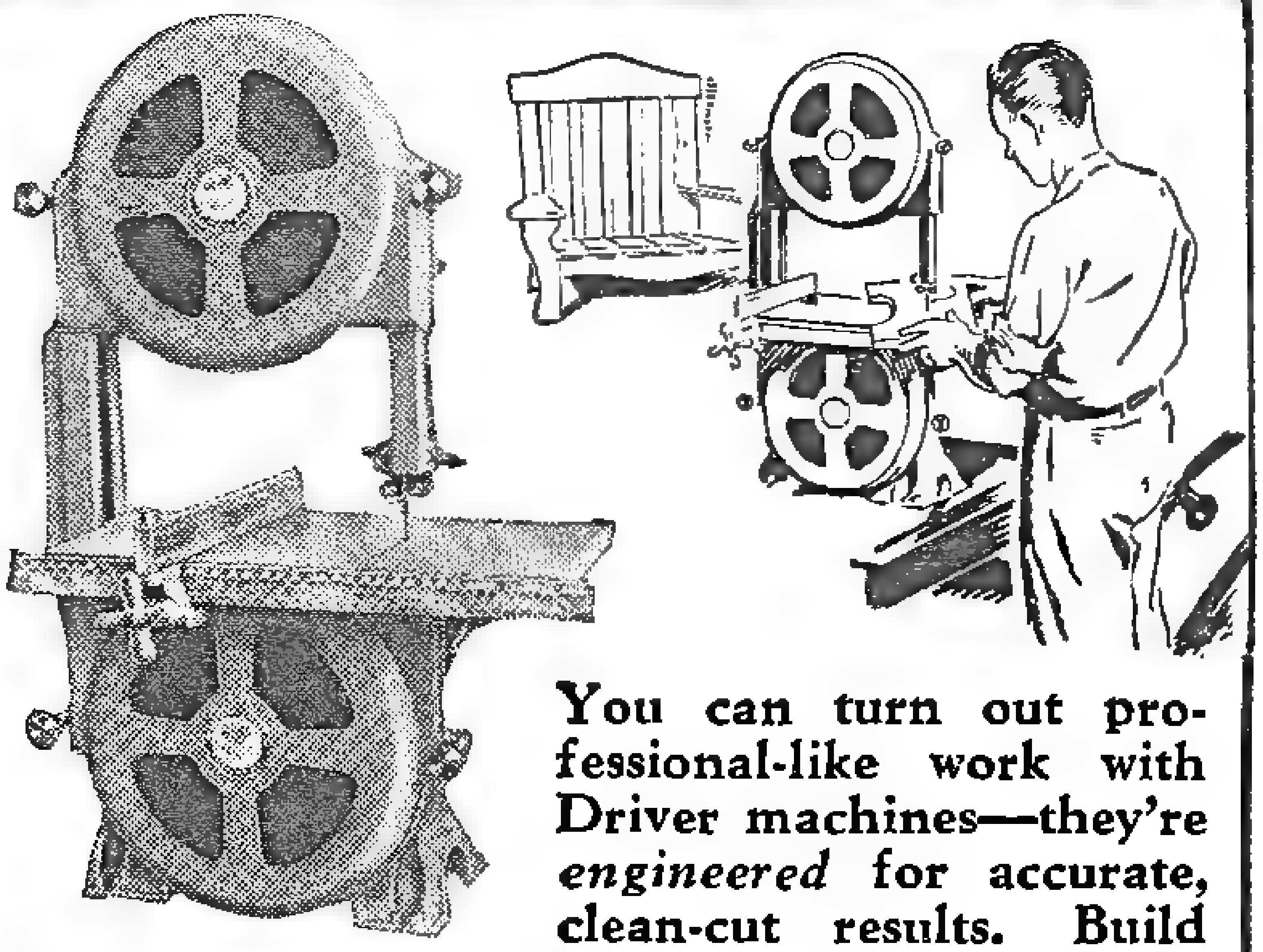

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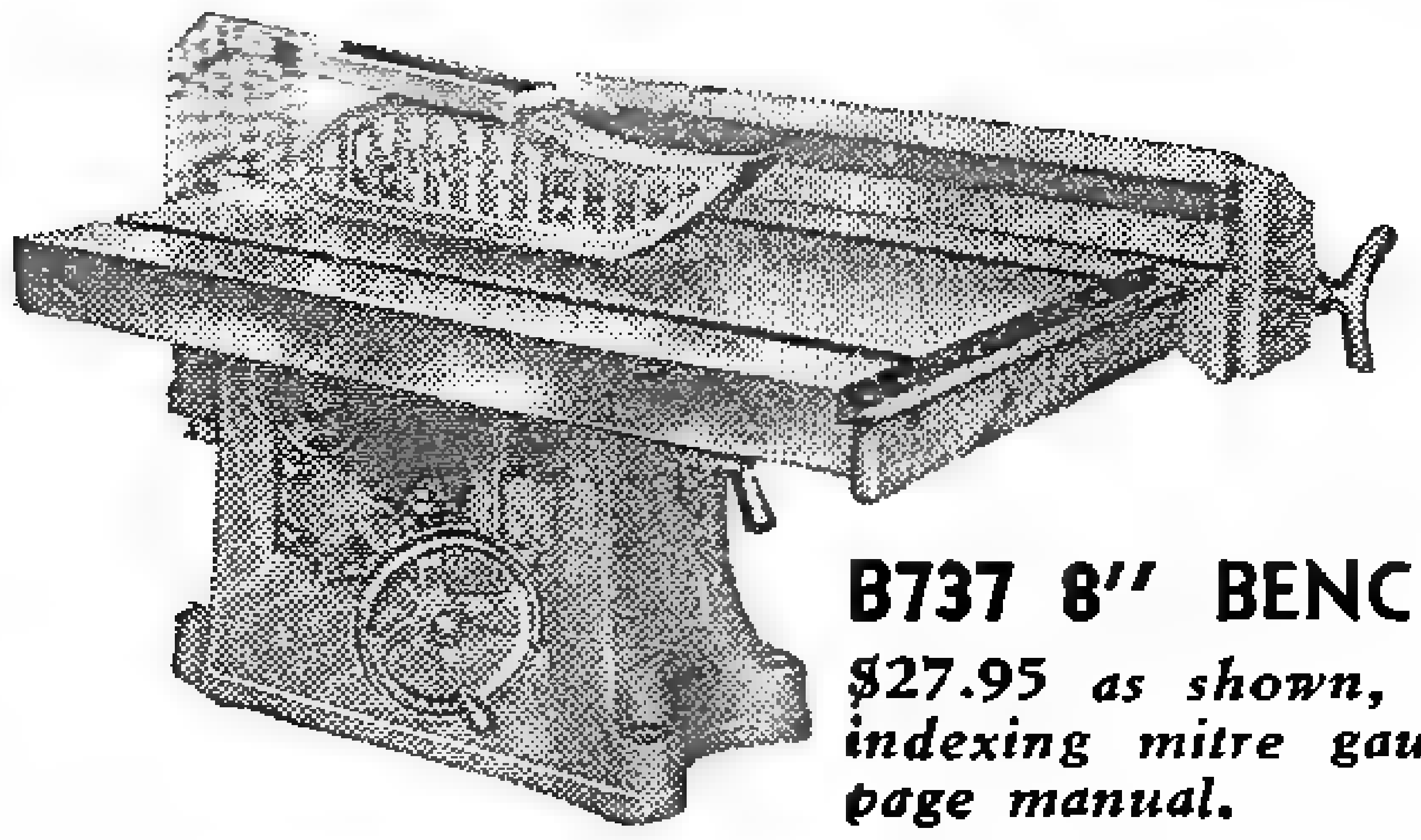

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How To Make Enlargements

[*Continued from page* 124]

so that no hypo will be carried back to the developer. At no time should you get a drop of any liquid on your fingers. Keep a towel around for emergency use, anyway.

Agitate the prints in the hypo every time you add a new one. Keep prints "fixing" here for not less than 15 minutes, and then transfer to a washing tray. Any ordinary tray can be made into a very efficient washer by the addition of the siphon type attachment pictured in Fig. 3. This costs about $5.00 and is well worth it. Improperly washed prints will fade in a few months, so keep them in the water at least 30 minutes, and preferably an hour.

Glossy prints are best dried on chromium plated "squeegee" plates. These are prepared for use merely by being washed with soap and then rinsed in hot water. Put the wet prints on the plate face down, place a piece of blotting paper over them, and roll them flat with a small print roller. Don't roll directly on the print; the paper is weak when wet and tears easily.

Any prints other than glossy are dried between blotters, under pressure. Remove the surface moisture by rolling them out a couple of times between one set of blotters, and then put them under a fresh, dry set. The blotters must be squeezed together pretty tightly to prevent the prints from drying in a wrinkled condition. There are many simple print presses on the market; or you can make one yourself in an hour out of a couple of small drawing boards or pieces of five-ply veneer.

College Glider Fan Devises Home-Built Altimeter

A University of Michigan glider enthusiast has invented an ingenious "home-made" rate of climb indicator for the use of soaring fans.

A thermos bottle, a glass U-tube, glass tubing and a calibrated scale constitute the device described by its inventor, L. D. Montgomery.

Water and a small "leak" are the essential features of the instrument. Changes in atmospheric pressure, which are proportional to the height of the plane, are registered by changes in the height of water in the U-tube. This device, essentially an altimeter, is converted into a rate of climb indicator by controlling the flow of water by means of the "leak," a fine capillary tube from the thermos bottle used to store the water. The thermos bottle is used to minimize changes in the temperature of the water which might throw the readings off considerably.

Chemists have tried to make diamonds in the laboratory ever since 1880, but have succeeded only in producing tiny crystals.

How To Train Your Dog

[*Continued from page* 124]

put on the inside so that he is walking between the trainer and the fence. The command "Heel" is given and if the dog attempts to walk ahead, the instructor can turn his leg inward and block the dog's passage, thus making him retreat. After a few walks, he will remain at his master's heels.

With this groundwork mastered, the dog is ready to learn a few stunts. Every dog-owner would like to have his dog retrieve objects, bring in the evening paper, or go upstairs and bring down house slippers when commanded to do so.

In giving a lesson in retrieving objects, the dog's play ball should not be used. To his mind this ball is associated with play and he will not regard it seriously. In its place a stick of wood or a wadded newspaper should be utilized. The dog should be kept on a clothes line while he is being taught to retrieve and the same is true when he is learning to carry a basket or a newspaper in his mouth.

The paper wad should be placed a few inches in front of the dog's mouth and the command "Hold" given. Lengthen the distance gradually and then place the object on the ground. From this point his progress will be rapid and he will be a good retriever within a short time.

In teaching him to carry objects, the newspaper wad should first be placed in his mouth with the command, "Hold" and removed after a minute or two. The procedure is repeated until he is ready to walk with the object. All you have to do is walk with your hand under his chin to prevent him from dropping the wad and coax him forward. By using the command "Carry" he will walk with the object in his mouth until he is told to put it down or into your hand.

For the best results the daily training periods should not be more than a half hour in length. Consistent, day-to-day work is necessary. Everything a dog has learned should be reviewed in each subsequent lesson. With the proper amount of patience and concentration, the average dog can be taught this primary course in a month's time, and from there, the trainer can write his own ticket.

Photographs Flame Cutting

High speed motion pictures of flame cutting have been made by H. R. Bullock of Massachusetts Institute of Technology. The pictures indicate that the oxygen stream of the oxyacetylene cutting process behaves very much like a stream of water from a faucet. The split second of contact between oxygen jet and steel was photographed. In the camera a prism rotating at high speed acted as a shutter and at the same time permitted continuous film motion. The film was exposed at the rate of 1,200 frames a second.

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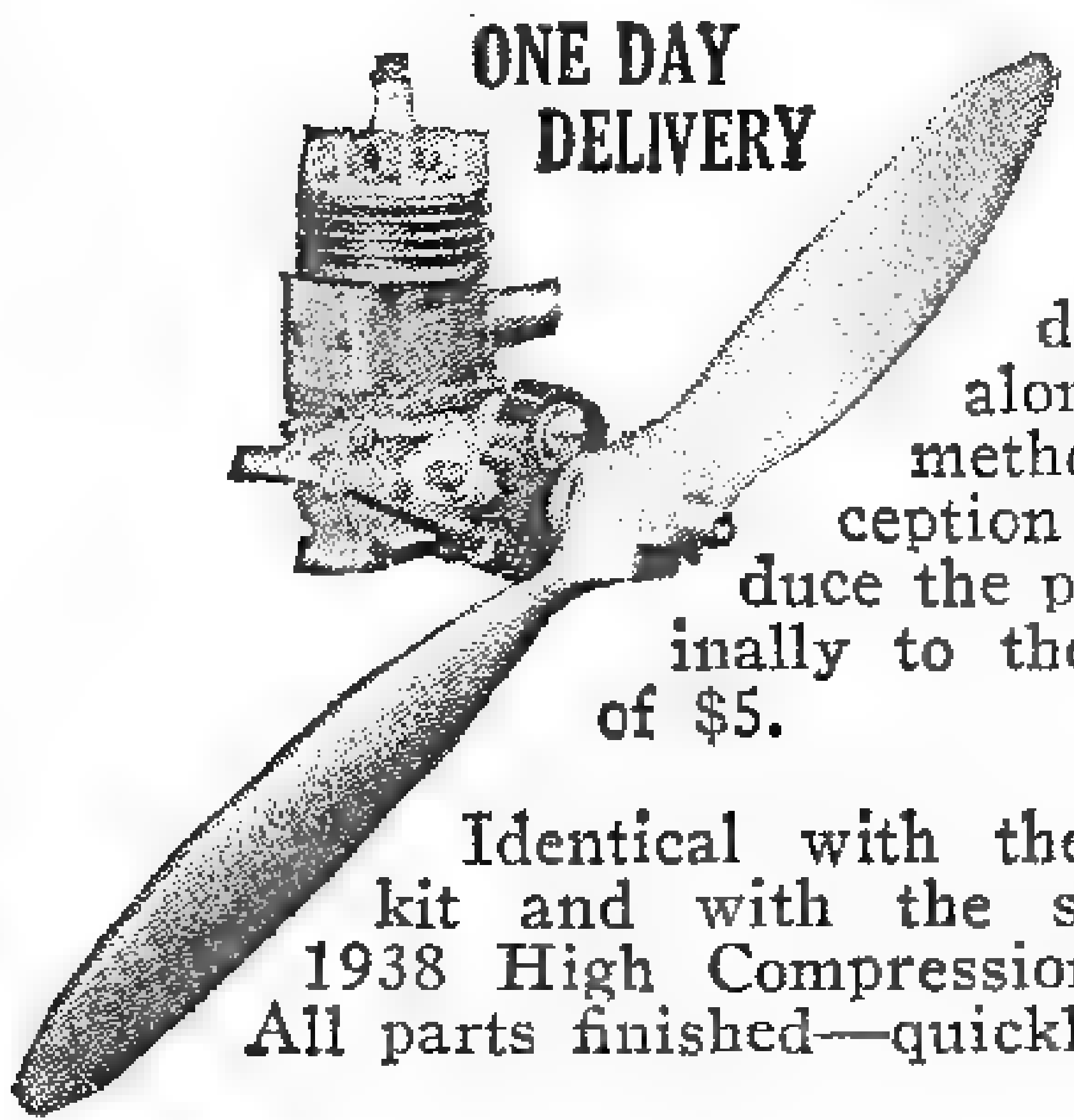

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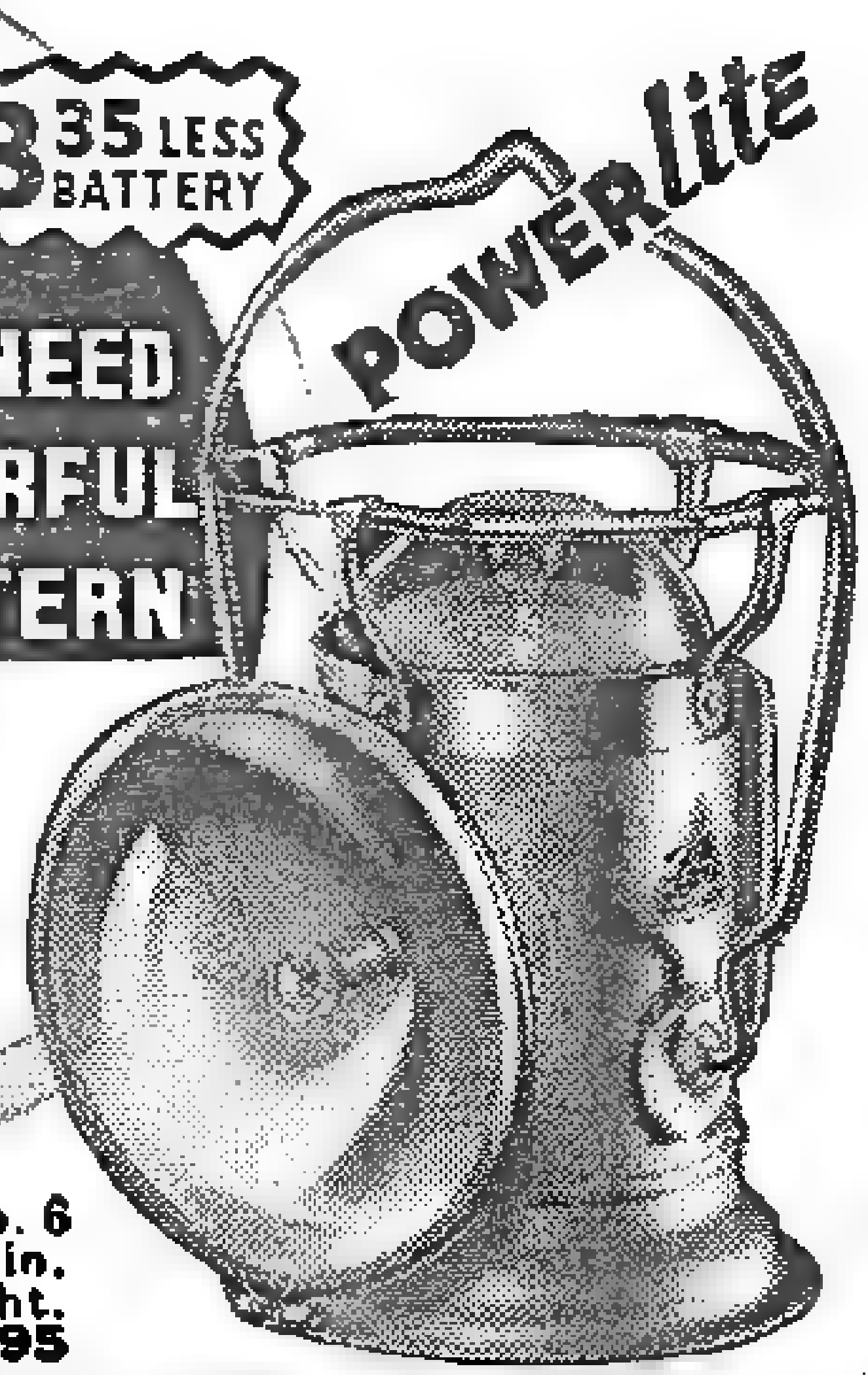

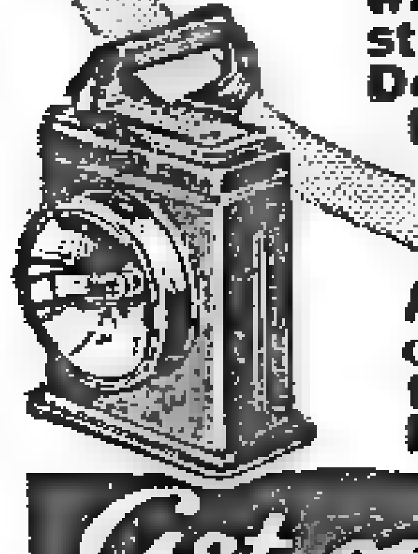

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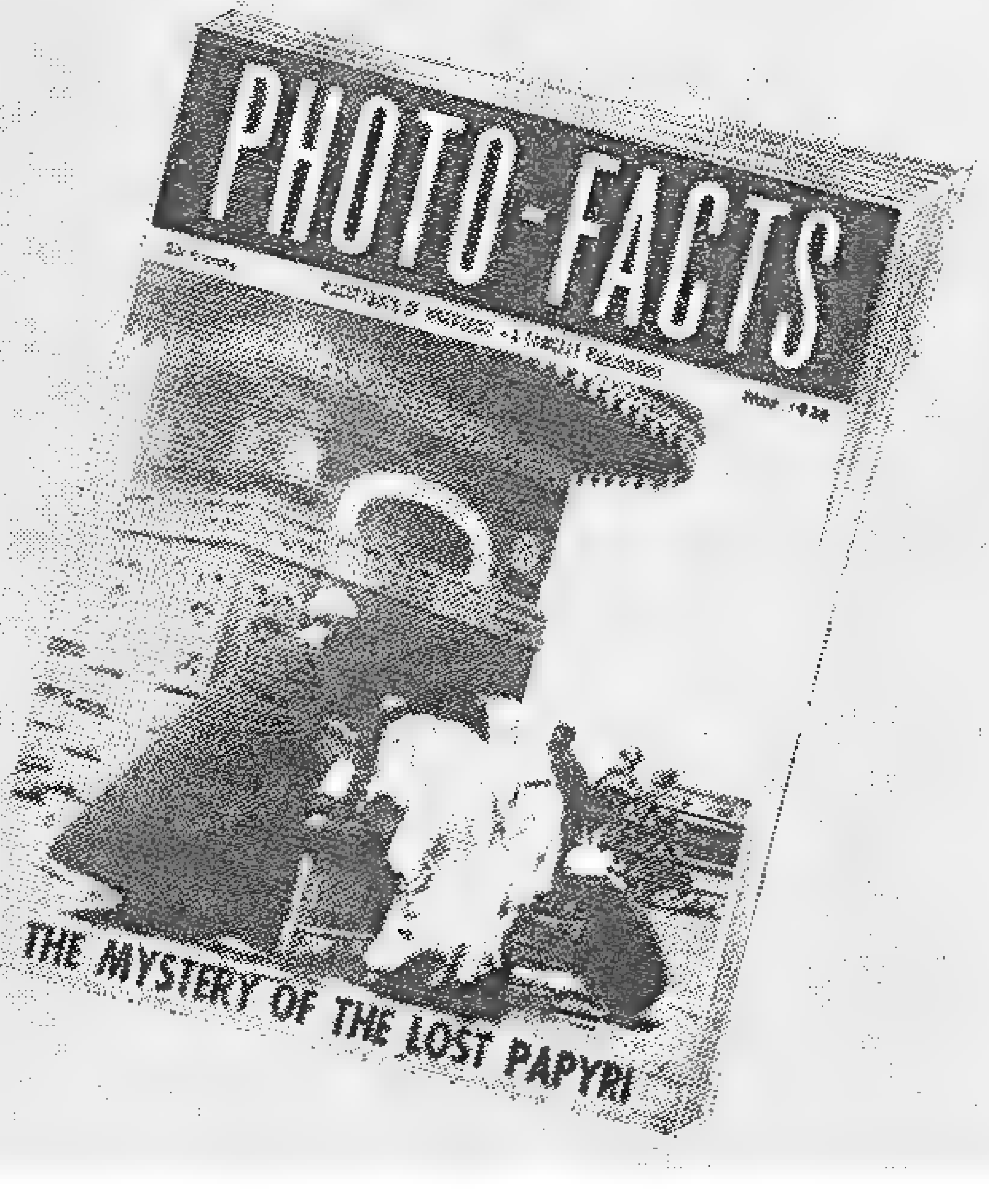

Engineer Reveals Results Of Lightning Studies

Lightning may strike a tree, travel to the ground, but if the soil happens to be of gravel or of a poor conductor type, it is liable to bounce out again and do further destructive work until it finds a ground of less resistance. This announcement was made by K. B. McEachron, in charge of General Electric's artificial lightning and high voltage laboratory, who has observed several occurrences of this character in connection with his recent investigation of lightning. In one of these cases, lightning came down a 90-foot pine tree and plowed up a furrow in the ground until it reached a pole supporting telephone wires. It went up the pole leaving some splintered wood behind, and finally found its ground connection after passing through the telephone wires.

In another case, in New Hampshire, lightning followed down a tree, traveled a distance of approximately 50 feet over the earth to pass up another tree, then jumped approximately one foot to a 110-volt lighting circuit, from which it dissipated itself in lightning arresters connected to the power circuit.

In a case but a month ago, the lightning discharge traveled through devious paths to finally reach the ground by way of an apple tree, 37 feet of earth, two metal beds, the body of a boy, a radio aerial, a secondary power line, and finally a telephone circuit. The boy was killed, several of the electric light circuits were put out of commission, and some damage was done to the telephone system. The boy was standing in a bunk house between two windows, apparently watching the storm. His body showed burns on his chest and one foot. How the accident happened was a mystery until Mr. McEachron made his investigation and determined the bolt had first struck a tree 37 feet from the bunk house, stripped off the bark as it traveled down to the base, followed a root of the tree for a few feet, then a small stream of water caused by the rain which carried it to the foundation of the bunk house. Here it tore off a patch of tarpaper along the foundation, came up through the floor and a bed, and passed through the boy's foot, up his body and left by way of his chest to an aluminum cooking pan hanging from a shelf but an inch or two from his body. It next jumped to a radio antenna strung under the eaves and then to an electric light lead just inside the building. From this, the lightning traveled over the electric light wires out the building to a nearby building in which the cord from a desk telephone was hanging over the metal part of a bridge lamp. Burns on the insulation of the wires and on the metal of the bridge lamp at this point indicated the lightning entered the telephone system and gradually dissipated itself to ground over the lightning arresters connected to the telephone system.

"If you are familiar with lightning, it is not difficult to trace its path," Mr. McEachron explained. "It generally leaves its mark wherever it goes. Our years of experience with artificial lightning, with voltages as high as ten million, have supplied us with much information useful in our study of natural lightning and how to guard against the damage it is liable to do. That is one reason for the fewer power failures during electrical storms in recent years. We have learned its habits and have been able to devise means for protecting electrical apparatus against it.

"In the case of the boy, the lightning discharge was seeking a good ground connection, and was only partially satisfied by the ground at the base of the tree. It followed the path of the least resistance, which was by way of the boy, antenna, light wires, and finally the telephone conductors to ground.

"When providing grounds for transmission towers, power stations, or lightning rod systems on buildings, grounds are provided by driven rods, buried wires, or pipes, often covering a considerable area. Lightning is discharged into such a system without damage."

This illustrates again the three main hazards of standing under a tree, which according to Mr. McEachron are: 1, the discharge may side-flash from the tree; 2, the discharge in passing through high-resistance soil at the base of the tree may pass considerable current up one leg of a person and down the other. This is often the reason why cattle are killed under trees. 3, the tree may explode and a person may be injured by the flying debris.

"Well-grounded lightning rod systems will protect buildings against damage from lightning in the majority of cases, and persons in such buildings will in general be safe," Mr. McEachron declares.

The great planet Jupiter is now about 500 million miles away from the earth.

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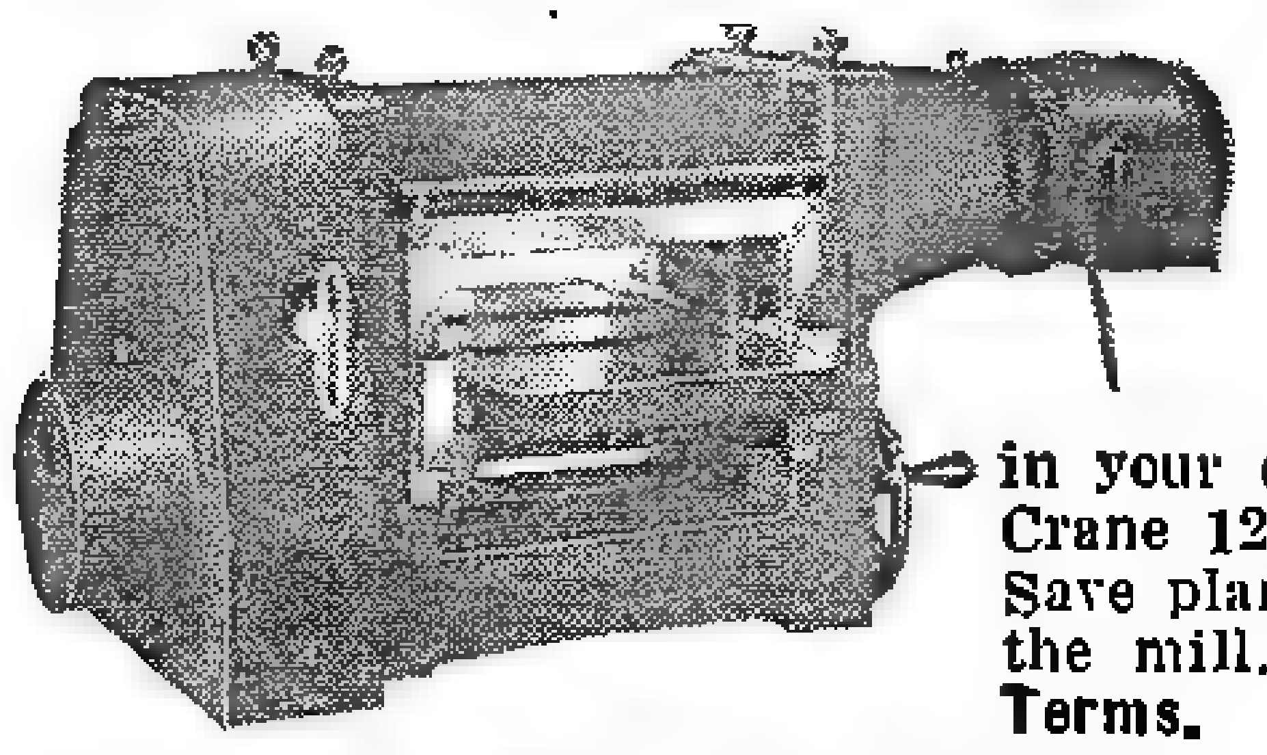

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Sound Engineers Produce "Stereophonic" Movies

AN EFFECT entirely new in talking pictures was recently demonstrated before a large gathering of motion picture engineers. It was a demonstration of "stereophonic" or third-dimension sound in which dialogue and sound effects come directly from the point of origin on the motion picture screen. The demonstration was given at the Bell Telephone Laboratories in New York City before members of the Society of Motion Picture Engineers.

In the demonstration, a ping pong game was shown on the screen and the sound of the bouncing ball followed the exact path of the ball itself. So accurate was the "sound path" of the ball as it traveled from one side of the net to the other, that it was easily possible to close the eyes and tell at any instant which side of the net the ball happened to hit. At one point of the game, the player missed the ball and it bounced off the table and disappeared behind the player. The *sound* of the bouncing ball likewise went to the floor and appeared to recede beyond the line of vision on the screen.

The development of "stereophonic" talking picture recording and reproduction is the result of a number of years of research carried on by engineers of Bell Telephone Laboratories and Electrical Research Products. The demonstration was described by J. P. Maxfield of the latter organization.

"In present-day talking pictures, we obtain only an illusion of sound coming from the point of origin on the screen," Mr. Maxfield said. "Actually, it comes from a fixed point behind the center of the screen with no direction or space-relationship. If for instance we see someone playing a piano on the screen, our ears and our eyes tell us that the sound of the piano is coming from the *keyboard* of the piano because we see the pianist strike the keys. There is no effect of sound motion on the screen. Stereophonic recording and reproduction provides this sound motion or direction."

"In ordinary talking pictures of today, sound is picked up with one microphone amplifier channel and recorded on only one sound track. The condition is actually similar to hearing with only one ear," Mr. Maxfield said, in explaining how third-dimension sound is produced. "In 'stereophonic' talking pictures sound is picked up by two channels and the output of each is recorded on a separate sound track on the film. In other words, there are two separate sound tracks on the film each of which is a recording of just one channel. In reproducing the two sound tracks in the theatre, the output of each track is fed to a separate set of loud speakers at the sides of the screen. The effect on the listener is that he is actually enjoying "two-ear hearing" (binaural) instead of "one-ear hearing."

Chemical Cure For Wounds

The cure of ulcers and stubborn wounds with allantoin, brought about through research work in the U. S. Department of Agriculture, has resulted, the department says, in wide interest among physicians and the public. Favorable reports have come in to the department from physicians, hospitals and patients throughout the country.

The story of allantoin goes back to the observations made during the world war by the late Dr. William S. Baer of Baltimore that maggot infested wounds frequently healed more quickly than wounds kept clean. Later, when maggots were used in treating stubborn wounds, the Department of Agriculture entomologists for a time supplied some hospitals with blowfly maggots.

Then the Bureau of Entomology set about learning new facts about these insects so long considered undesirable and odious. Dr. William Robinson of that bureau learned how to grow clean maggots—free of any infection—something much desired by the medical profession. He then began research to find out what the insects produced in wounds that might explain the stimulation of healing. He found they produced, among other things, allantoin, a substance occurring in some plants and animals and which long ago had been suggested as a healer of ulcers.

At the time he made this discovery allantoin was known only as a rare chemical and was prepared in small quantities. With this new use of allantoin the demand for it grew. Now at least six concerns are making it. The maggot is out of the picture. In fact, the insect provided only the basis for a start with this new healing agent as even the early tests were made with the artificial product, which is almost snow white.

More recently Dr. Robinson has shown that the maggots produce urea, and collaborating physicians have shown that this substance, the first organic chemical ever to be made synthetically, is much like allantoin in its effect on ulcers and sores. It also is a crystalline substance which under the microscope resembles tiny splinters of sparkling ice. It is cheap and the commercial grades are manufactured in huge quantities for fertilizer and for various uses in industry.

Both allantoin and urea are being used extensively by physicians. A single manufacturer of allantoin reports a regular output of the chemical sufficient to treat 1,000 average cases each month. Some pharmaceutical companies are now putting out allantoin—and in some cases urea—in various forms, including ointment, jelly, dusting powder, in addition to the original crystal form and water solution.

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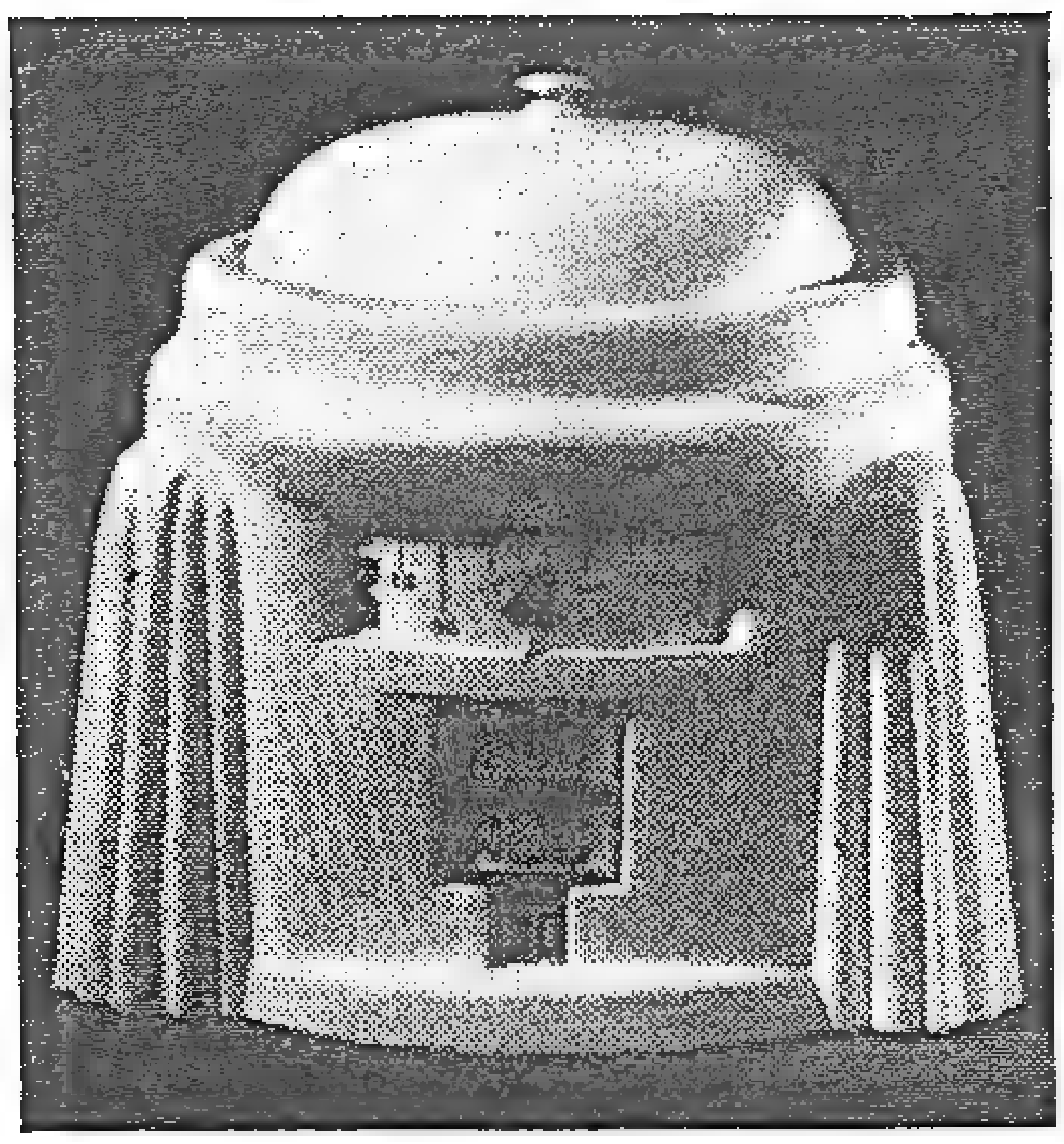

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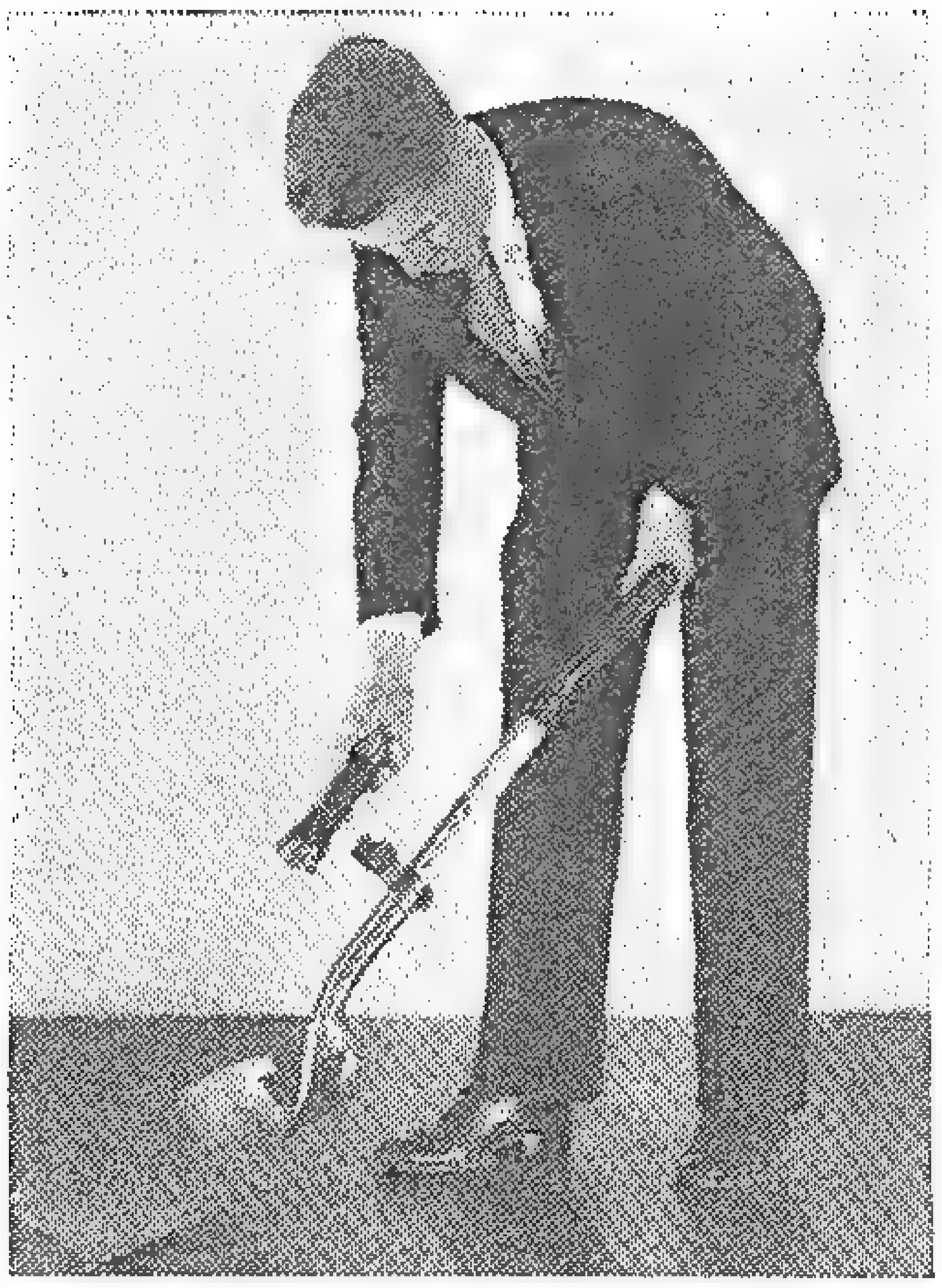

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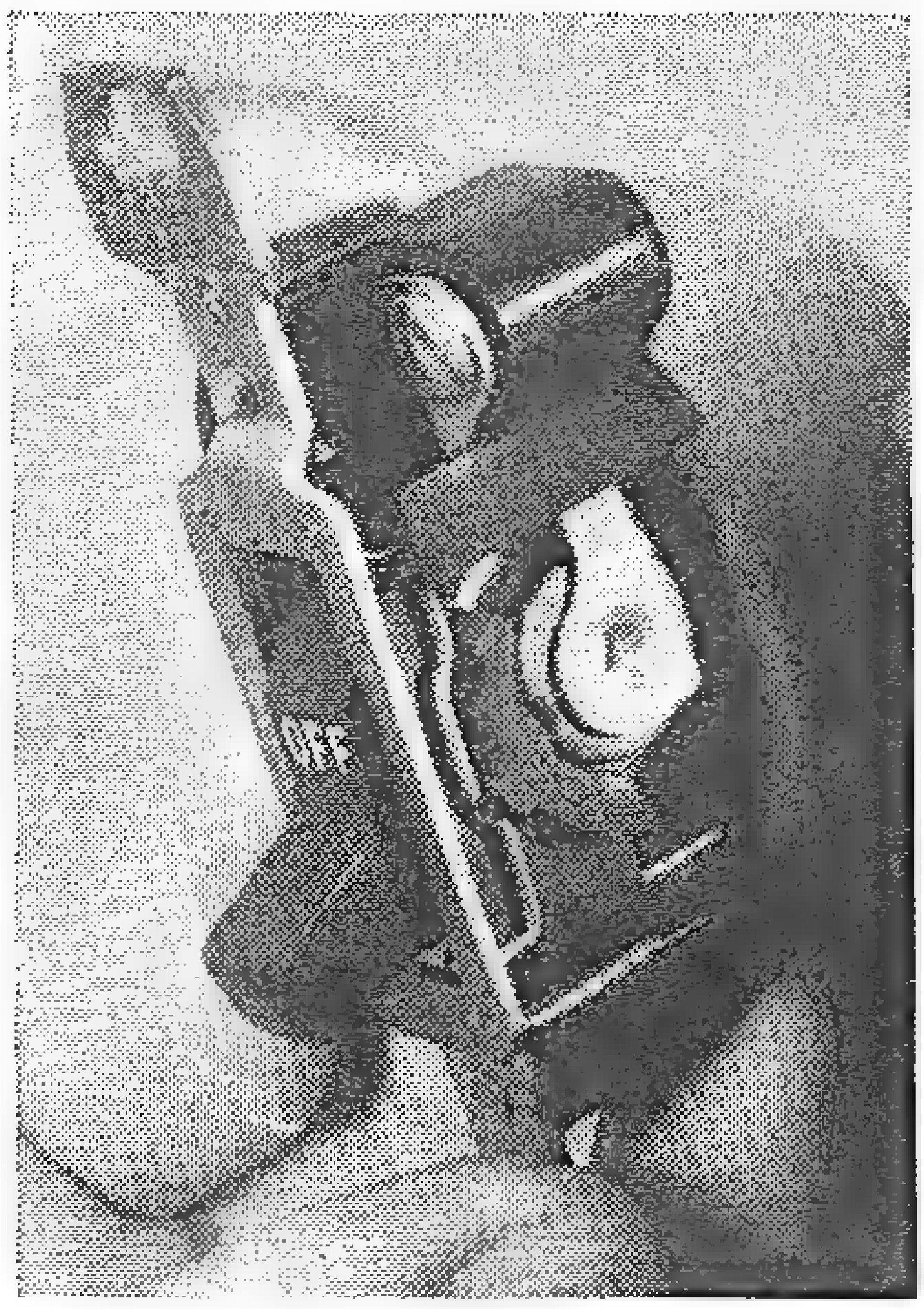

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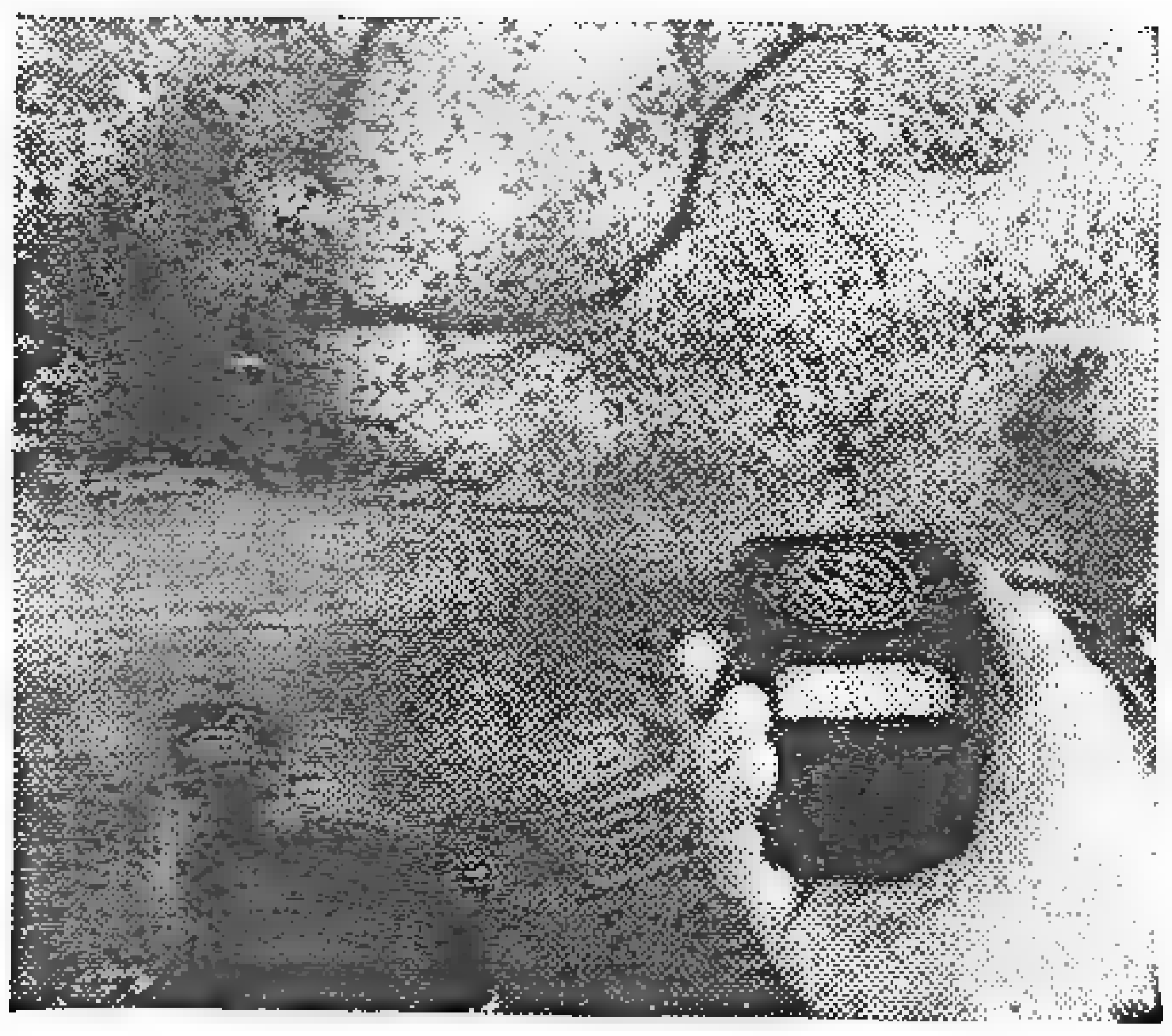
Exposure Meter Has Light-Limit Hood



Designed for use over a wide range of illumination levels, a new exposure meter, shown above, has a special hood to limit more effectively the angle of the light received to approximately that of a camera. This lessens the error of indication caused by strong sky light.

Shaving Mirror Has Built-In Light

In addition to being illuminated, a newly developed shaving mirror has the added advantage of having an outlet in its back to which an electric razor can be connected. The mirror has a translucent area near the bottom through which the light from a small bulb illuminates the face of the shaver without casting shadows.

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HAVE YOU a sound, practical invention for sale, patented or unpatented? If so, write Chartered Institute of American Inventors, Dept. 5-A, Washington, D. C.

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INVENTIONS Commercialized. Patented or unpatented. Write Adam Fisher Co., 582 Enright, St. Louis, Mo.

GET Your Own Patents. Legal blanks, complete instructions $1. Cudding Sons, Campbell, California.

Device Clamps Pan To Table, Freeing Hands For Stirring

Shown above is a new household aid which serves to hold a kitchen pan or bowl in place while the contents is stirred, leaving the operator's hands free for the job. The device is adjustable to permit its use with pans of varying size.

PERSONAL

STUTTERING and Stammering corrected at home. Booklet free. Paul J. Wolfe, Box 52, Pittsburgh, Penna.

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DEVELOP and print your own pictures. Save time, money with our complete outfit, $1.95 plus postage, or sent C.O.D. Includes electric ruby lamp, printing frame, photo paper, chemicals and equipment. One of hundreds of amazing bargains in our free, newest, money-saving bargain book. Send for it today! Central Camera Co., 230 So. Wabash, Dept. 14-J, Chicago.

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PLANS 18 Distance Crystal Sets—SW record 4250 miles, with "Radiobuilder" year—25c. Laboratories, 151-K Liberty, San Francisco.

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TWENTY Surgical Bluesteel double edged blades 25c. Bladeco, 3001—4th Ave., Huntington, West Virginia.

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WANTED County Distributors. Excellent opportunity for earnings. Nationally advertised product. Large company. Dept. 257, Fyr-Fyter Company, Dayton, Ohio.

POPCORN Machines, Carmelcrisp, Crispettes, Cheese Coat, Potato Chips. Write for catalog. Long Eakins, 2029 High St., Springfield, Ohio.

ATLAS Window Sign letters. Large Sizes, Penny Each. Beautiful Free Samples. Atlas, 7941-G Halsted, Chicago.

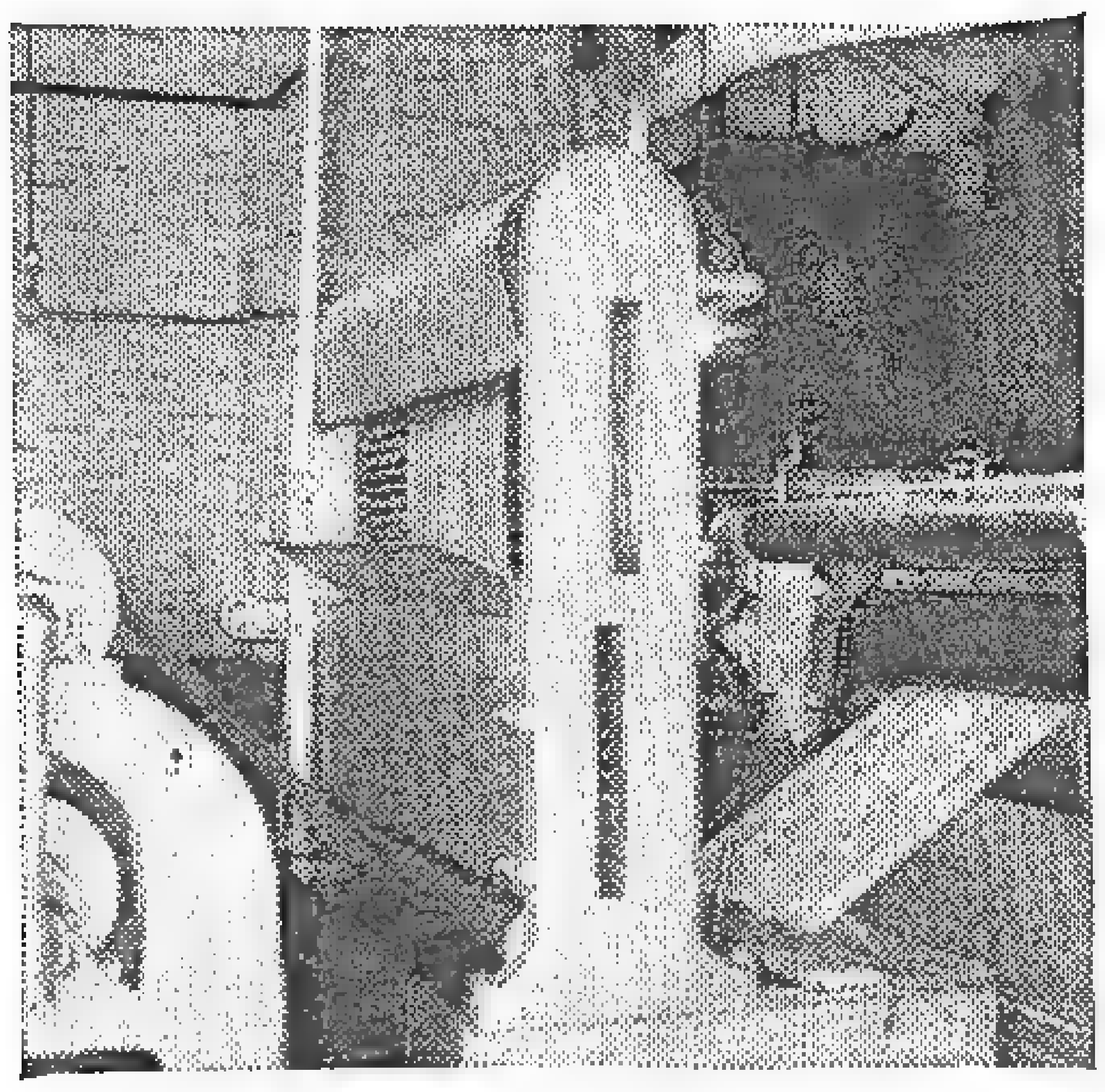
SPECTROSCOPES

SPECTROSCOPE with book of 120 experiments, $2.50. Cudding Sons, Campbell, California.

TELESCOPES, MICROSCOPES, ETC

TELESCOPES, Microscopes, Binoculars; 1938 bargain catalog free. Brownscope Company, 5 West 27th Street, New York.

Machine Puts Gloss On Waxed Paper



Shown above is a new paper mill machine which is used to impart a high gloss to sheets of waxed paper. Melted paraffine is put on a sheet of paper by means of a chilled iron roll and rubber roll, working in conjunction with each other at a temperature of 135 degrees Fahrenheit. While the wax is still molten, the sheet is dipped into a water bath of a 38 degree temperature. The water is then removed from the sheet by the new machine and a gloss imparted in the process.

TELESCOPES, Microscopes, Binoculars, Mineralogy, Chemistry. Catalog free. Teeko, Evanston, Illinois.

DUPONT Superior Panchromatic, 35 mm; 25 ft. roll, $1. Optical Laboratories, Larchmont, N. Y.

6" REFLECTING Telescope Lense. 52" Fl. 100 power. Price $10. Box 298, Mansfield, Ohio.

VENTRILOQUISM

LEARN Ventriloquism by mail; small cost, 3c stamp brings particulars. Geo. W. Smith, 125 North Jefferson, Room S693, Peoria, Ill.

LEARN Ventriloquist Art. Easy. Low Cost. Details Stamp. Apex, 221 E. 31, New York.

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ULTRA Violet-Infra Red. Dual Ray Health Lamp. Two separate units in one. Promotes Sun Tan—Vitamin "D." Automatic control. AC-DC current, $3.90 postpaid. Details Free. Beyer Mfg. Co., 4515-M Cottage Grove, Chicago.

WELDING

REMOTE CONTROL: Arc-welder 25-125 amperes 40 volts D. C. DUAL CONTROL 25-200 Home-made from North-East (Dodge) automobile generators, without rewinding armature. New method designed for beginners. Over 3,000 words, real facts, actual welding views. Certified Instructive Plans $1.00 C. O. D. $1.12. Airmail 12c extra. Welders Club of America-B, B-3432, M-Mart, Chicago.

ARC-WELDER Home-Made from original North-East (Dodge) 12 volt automobile generator. No rewinding. Plans $1.00. Welders Club of America-B, B-3432, M-Mart, Chicago.

WIND ELECTRIC PLANTS

FREE Electricity from Wind. Build your own Windcharger. Cost 98c for material plus used car generator. Drawings—Instructions 10c. Wesco, Minneapolis, Minn.

Europe Surpassing America In Aviation Progress

Unless America keeps pace foreign aviation expansion will shortly outstrip the present front-running position of the vital military and commercial aeronautical industry in this country, warned Arthur Nutt, engineer of the Wright Aeronautical Company at a National Aeronautic Association meeting sponsored by the Society of Automotive Engineers.

Mr. Nutt, returning from his second trip in three years to the airplane engine factories of European powers, emphasized his warning with the following:

1. Germany has a single airplane engine factory which has more floor space than all the factories of all the American aviation engine companies combined. The Reich is concentrating on Diesel engines, with its realization that in wartime gasoline will be curtailed.
2. Russia is producing American engines, under license, in factories that are twice as large as those of the parent American companies.
3. The greater number of mechanics in European airplane factories represents inefficient operation much less than it does the desire to train men for wartime expansions.
4. Italy has a large expansion program and is overcoming a deficiency of personnel and materials.
5. Political unrest and labor troubles have handicapped France in the last two years but development of liquid-cooled engines continues.
6. England, after its late start in expanding its aviation production facilities, shows phenomenal progress. Several hundred military airplanes have speed of between 300 and 350 miles an hour. In the Rolls and Bristol engines it has two of the world's best.
7. Emphasis in Europe on military airplane engines puts more stress on maximum, short-time performance and less on the American standard of reliability and durability.
8. Contrary to the secrecy which often surrounds American airplane factories the European factories give a warm reception to reputable visitors.
9. In experimental laboratory testing equipment Europe is definitely ahead of America. The result of this fact is not yet apparent but soon will be as measured by future developments.

ADLETS FOR HOBBYISTS

(See regular classified section for rates and other information.)

STAMPS

SUPER-WONDER Packet offered, containing 60 different stamps from Afghanistan, Transjordania, North Borneo, Manchukuo, Sudan, Guadeloupe, Iraq, Sarawak, French and British Colonies, including natives, beasts, ships etc., all for only 5c to approval applicants. Big illustrated lists free. Kent Stamp Company, Box 87-Z (G. P. O.) Brooklyn, N. Y.

STAMP CATALOGUE FREE:—Special Gift Edition—Giant forty-page quarterly listing Albums, Supplies, Coronations, British Colonials, Canadians, United States, Sets and Airmails. Illustrations galore! EMPIRE STAMPCO., Dept. MM., Toronto, Canada.

1897 Grande Comore Islands, rare old genuine Balloon, Turks Caicos, $5 U. S., British Colony Map Stamp, Western Samoa, etc. Everything 3c with approvals. Viking 1-MM, Hanson Place, Brooklyn, N. Y.

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DIAMOND Airpost Commemorative Issue Complete, Proletariat Portraits Complete, Dragon Stamp, with 117 additional, cataloging $3.00, only 10c. Friendly Filatelists, Box 4428M, Philadelphia, Penna.

NEW Rivera nude stamp! World's largest triangle! Congo, Sudan, South Seas, bicolors, pictorials and many others. Only 3c with approvals. Cactus Junior Approvals, Box 1870-D, Tucson, Arizona.

STAMPS! 100 diff. 3c; 500 diff. 35c; 1,000 diff. 90c! Illustrated Album (4000 spaces) 22c. Approvals sent. Tatham Stamp Co. (D9) Springfield, Mass.

MONTHLY Stamp Magazine, 6 months and 25 foreign stamps, 25c. American Stamp Journal, Cedar Rapids, Iowa.

UNITED STATES—125 different $1; 75 different 30c; 45 different 10c. Sidenburg, Baroda, Mich.

FREE!!! Two Coronation Sets. Postage 3c. Roberts, 312T Shearerbldg, Baycity, Michigan.

COINS

FREE: Foreign Coin, Banknote and Large Illustrated coin catalogue, for 4c postage. Approvals sent. Tatham Coinco, Springfield-9, Mass.

COINS, Beadwork, Indian Relics, Minerals, Books, Curios, Stamps. Catalogue, 5c. Indian Museum, Northbranch, Kansas.

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$5.00 TO $500.00 EACH paid for hundreds of Old or Odd Coins. Keep all until posted. Send 10 cents for Illustrated coin value book, 4x6. Guaranteed buying and selling prices. In business 31 years. Stamps, Old gold and silver also bought. Coin Exchange, Box 43, LeRoy, N. Y.

ANTIQUE FIREARMS

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INDIAN CURIOS. 100 good ancient Arrowheads $3.00. Tomahawk Head 50c. Illustrated catalog 5c. H. Daniel, Hot Springs, Arkansas.

INDIAN RELICS

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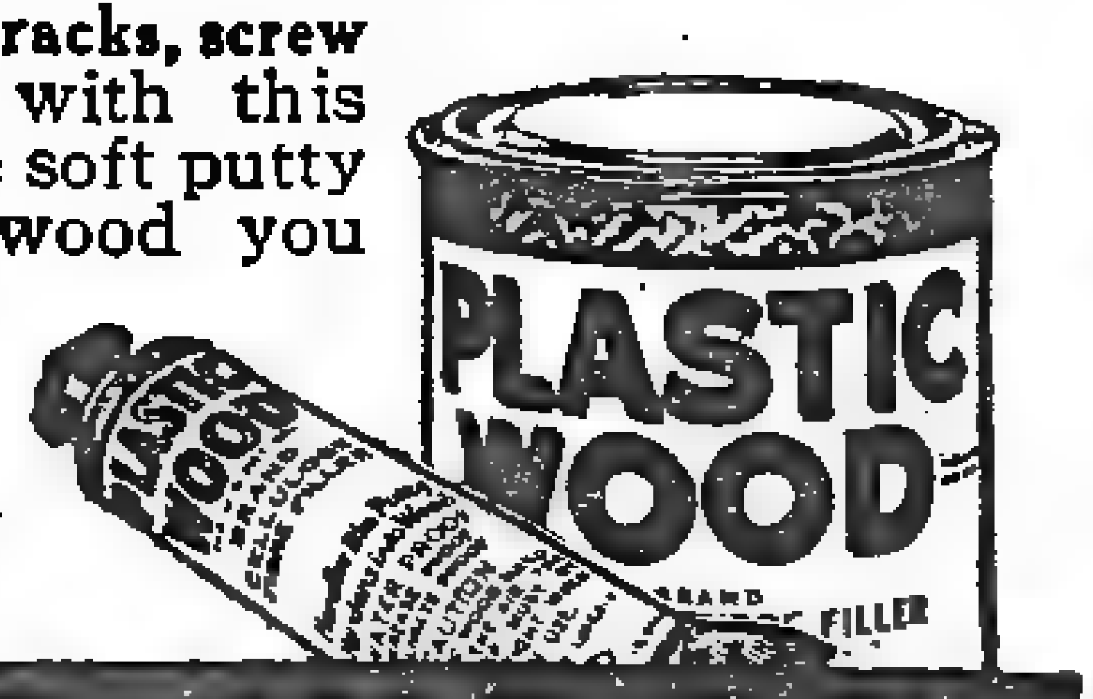

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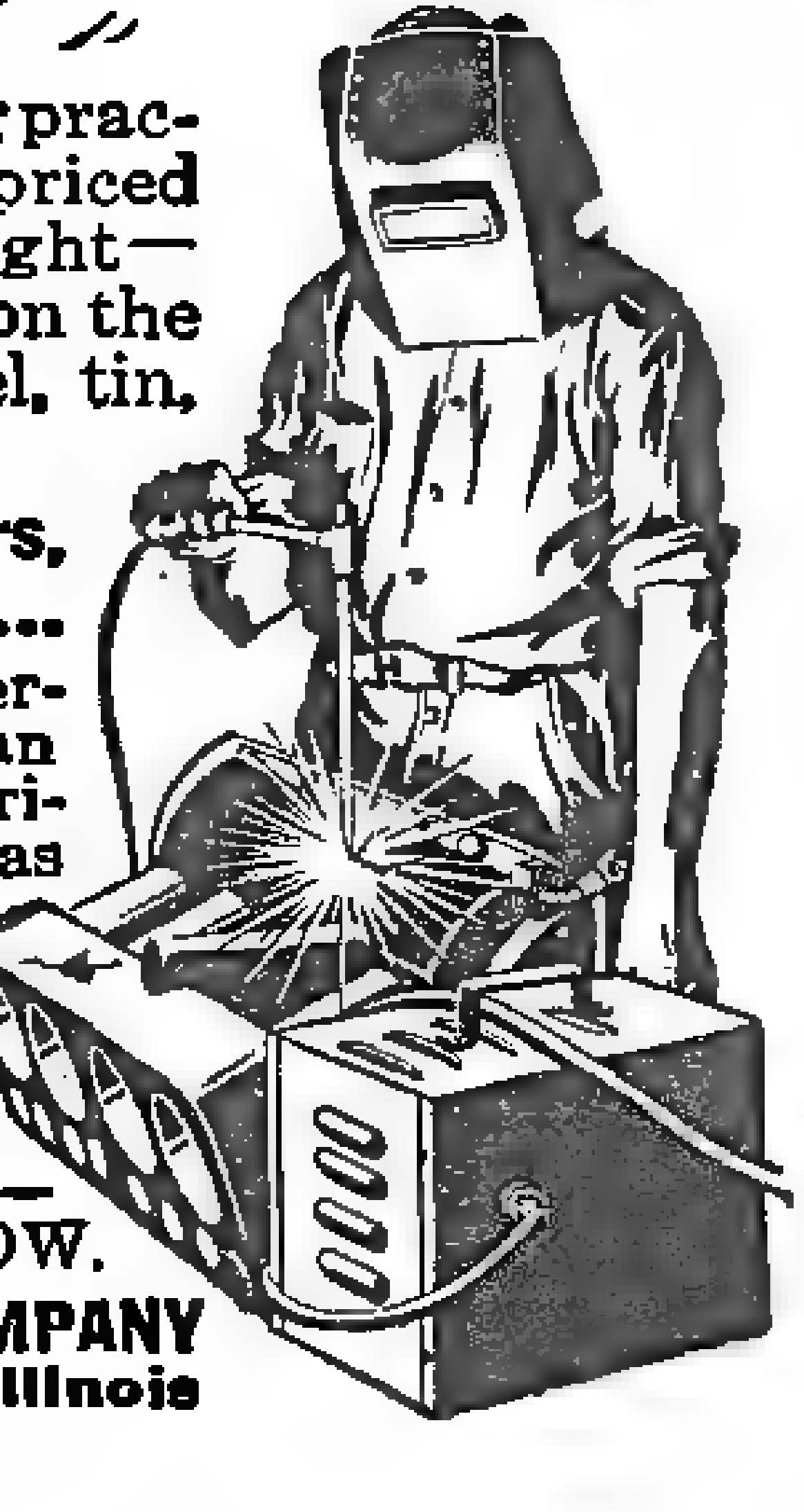

DYNAMIC WELDER COMPANY
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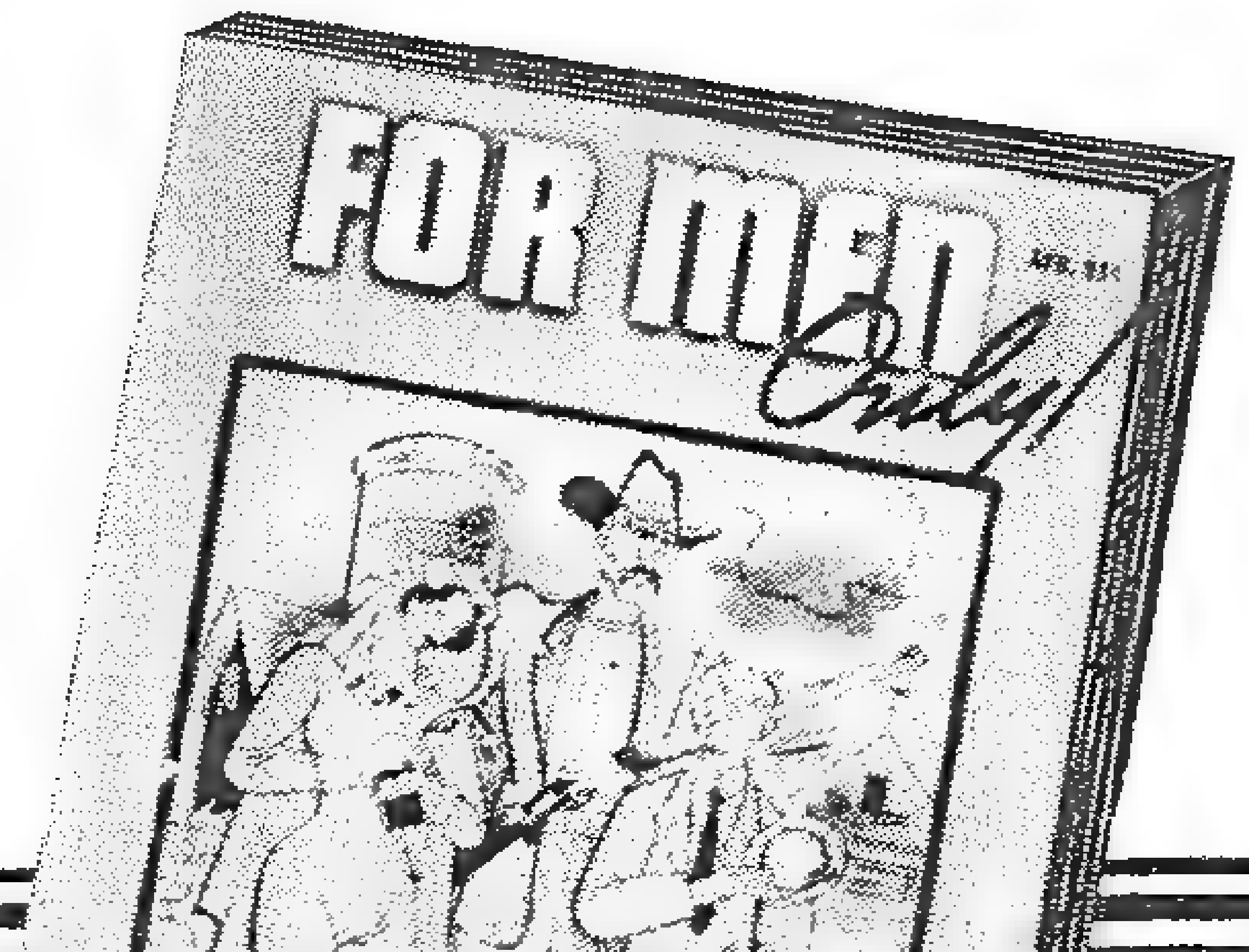
LOOK WHO'S LAUGHING!

MAKING a comedian laugh is generally a pretty large order. Unless our eyes deceive us, though, Jack Oakie seems to be genuinely amused by the latest issue of FOR MEN ONLY. In fact, we hear from reliable sources that the genial President of Oakie Radio College plans to make FOR MEN ONLY required reading for the students—and faculty.

THE April issue is just out—with another two dozen hilarious color cartoons, and twenty-odd lusty, entertaining articles by some of America's favorite authors.



FOR MEN Only!

NOW ON SALE
AT ALL NEWSSTANDS . 25c

New "Synthetic Rubber"

Outside of the technical industries concerned, most people may yet feel that "synthetic rubber," or rubber-like materials, is still a laboratory curiosity. How many know, for example, that six products now on the American market are rivals of rubber? Some are true synthetics, built in the laboratory, while others are derived from natural rubber but have special and desirable properties.

Pioneer of the rubber-like substance is Thiokol, which is available in sheets, as a liquid, or as a powder for molding. Like rubber, it can be vulcanized, but has the additional valuable property of being impervious to gasoline and does not swell and quickly disintegrate.

Koroseal is the rubber-like plastic with properties that make it desirable where natural rubber fails. It can be obtained in hardness that runs all the way from a soft jelly to hard rubber. You can mold it, make sheets out of it or extrude it from openings. Remarkable resistance to light, water, air and certain corrosive chemicals and oils are its merits. Chief use is in the impregnation or coating of fabrics, paper and metals.

AXF is another rubber-like synthetic organic compound which makes hard rubber flexible and aids in overcoming the deterioration due to ozone.

DuPrene is one of the newest and most widely known synthetic products having rubber-like properties, which has greater resistance to oil, grease, gasoline and air and heat than natural rubber. Tires have already been built with it and performed satisfactorily. Leather, fabrics, asbestos and cork have already been coated with it for special service.

Plioform is a rubber derivative made from pale crepe rubber. It resists the attack of water, all alkalies and most acids. It has excellent electrical insulation properties. This plastic has wide usefulness in the field of sound production. When used as a sounding board it approaches violin wood in producing pleasing tones.

Sixth of the rubber-like materials is Tornesite, a rubber derivative, whose present function is primarily in the coating of metals. It shows resistance to acids, alkalies, smoke and fumes and can be applied with a brush or as a spray.

In the commercial sense there is little reason why the synthetic rubber-like plastics should exactly duplicate the natural products. While the search for synthetic rubber originally had that goal, the present products nave excelled rubber in many ways and lack only the price angle to be highly competitive on a wide scale.

Astronomers have found nothing so satisfactory for making a system of fine guiding lines on a telescope, as a spider web.

Astronomers cannot examine the surface of the planet Venus, because clouds hide it.

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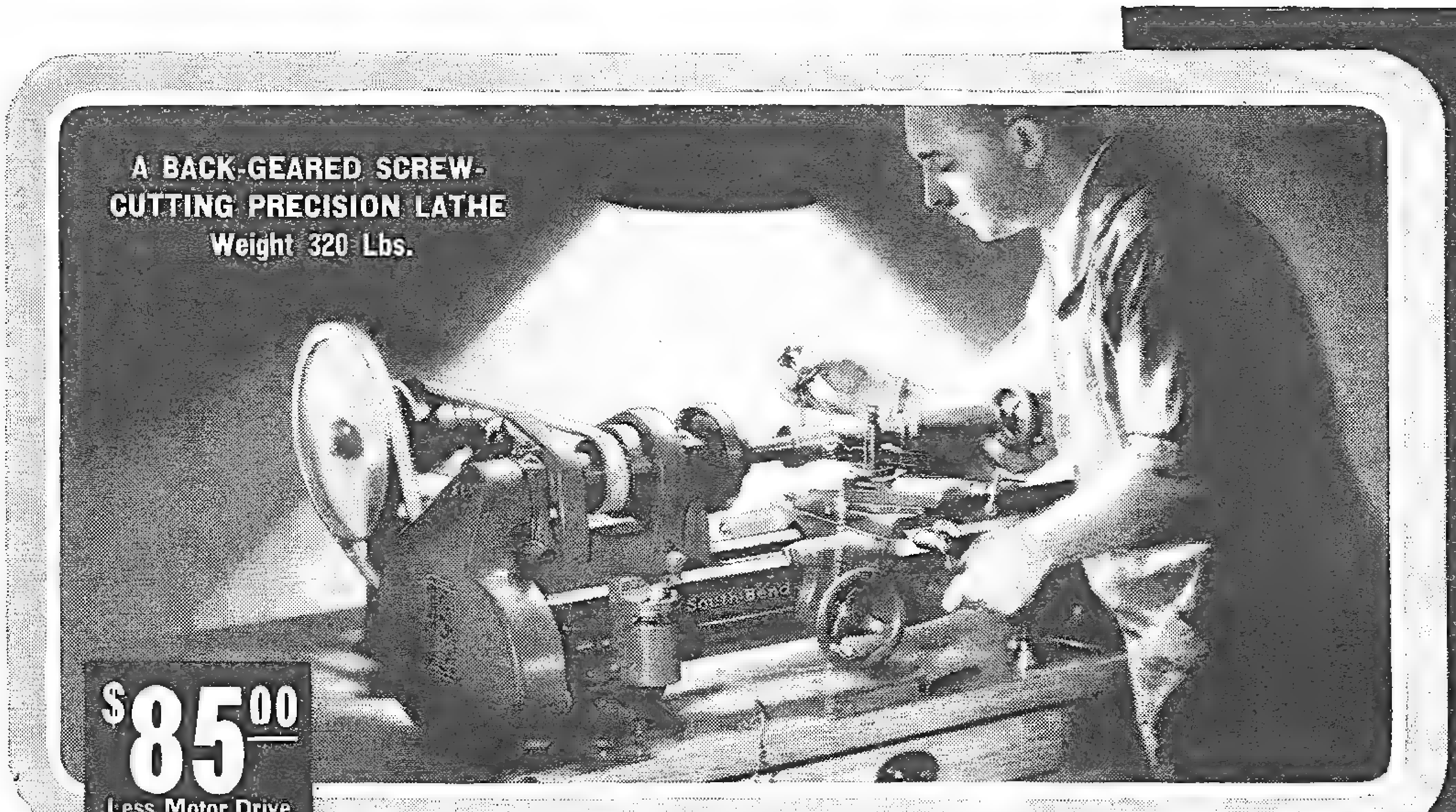

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Features—Twin Gear Reverse to Lead Screw, Ball Thrust Bearing on spindle, cuts screw threads from 4 to 112 per inch, ¾" spindle hole taking collets up to ½".

Made in 3', 3½', 4' and 4½' bed lengths. Operates from lamp socket at less than 2 cents per hour.

Write for information about the modern motor service shop. Learn how to do many profitable jobs.

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"How to Run a Lathe"—160 pages, over 300 illustrations on lathe operation. Auto Workshop Bulletin No. 33-G shows how to do auto service jobs. Catalog No. 46 shows, describes 9" lathe in all sizes. Use coupon.

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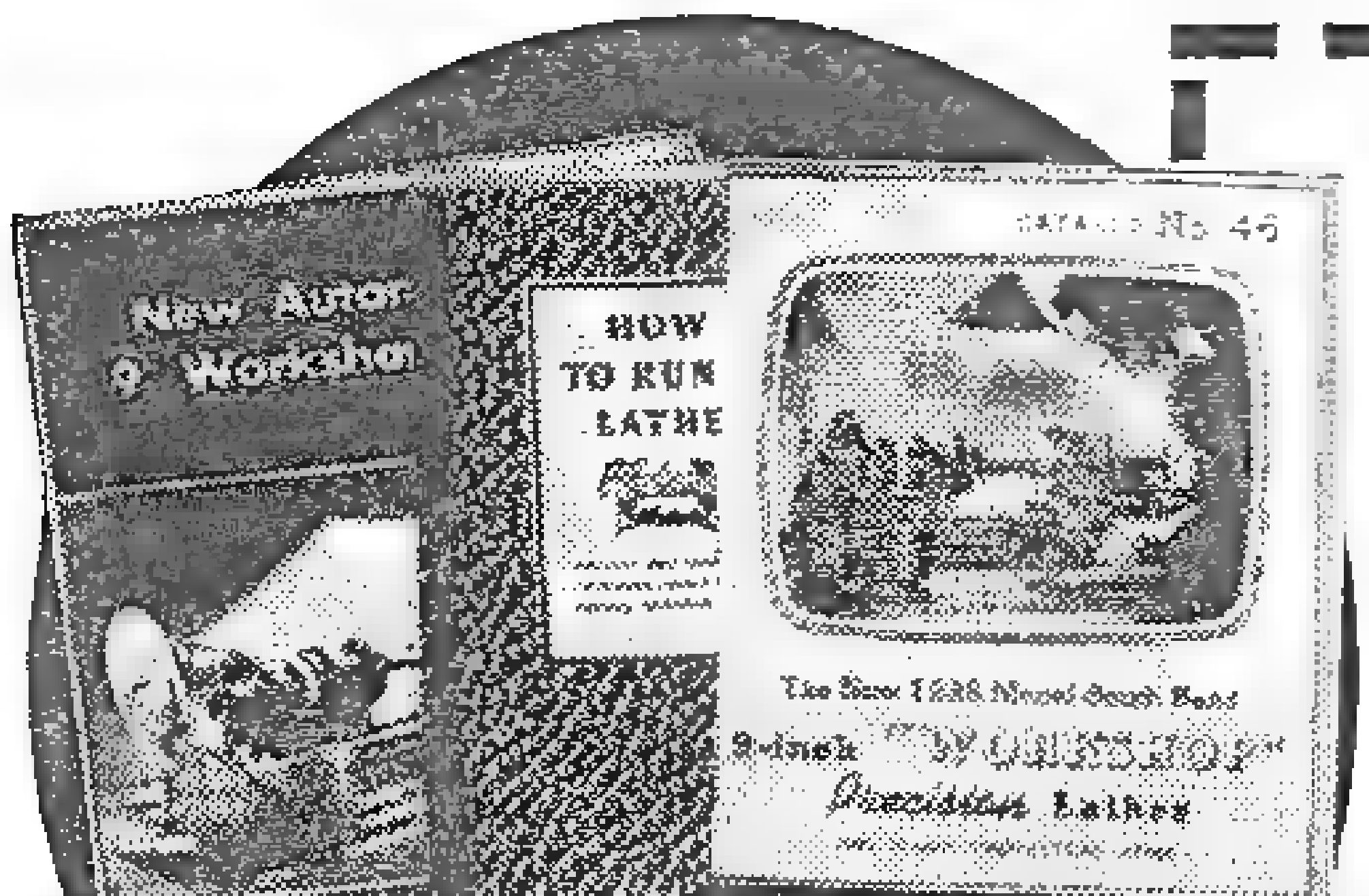

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The 9" x 3' South Bend Precision Lathe does these operations:
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There are 5 sizes of South Bend Lathes—9", 11", 13", 15" and 16" swing with bed lengths 3' to 12'. In motor or countershaft drives. Priced $85 to $1500.

Depth "Thermometer" Shows Temperatures Within Earth

Scientists looking forward to the day when the earth's insides will be tapped for heat and power have a new tool to aid them in locating the "hot spots" below the earth's surface.

It is a depth "thermometer" for taking the temperature thousands of feet underground. Ernest N. Merrill and George A. Young, both of Long Beach, Calif., are the inventors who have been granted a patent covering the device.

More and more, scientists and oil companies have become interested in just how hot things are down under. They know that the temperature increases the further down you go.

From readings already obtained, scientists have been able to make a rough estimate of the age of the oldest rocks, and to infer from this result that the amount of heat which is being supplied to the earth from radioactive minerals may be much less than heretofore supposed. They have found, also, that generally the western part of the United States is hotter underneath than the eastern part of the country. This result is in agreement with the conclusion of the historical geologists that the Rocky Mountains are younger than the Appalachians.

However, aside from pure research, subsurface earth temperatures have a present day practical aspect for the oil man. Attached to a long steel wire, he drops thermometers down the wells as he drills deeper, pulls them up, reads the temperature.

Should the drill be passing through rock strata where there is liable to be water, he can tell from his temperature readings what precautions should be taken to insure a water-tight cement job under such high temperatures and pressures.

Bullet-shaped, the new thermometer, claimed to be more efficient than anything heretofore used, comprises a water-tight metal case. Into this goes a metal box provided with many compartments. Through the bottom of the box in each compartment and through its cover are small holes.

Each compartment contains sharp edged plates of various alloys which are the "mercury" of this thermometer. It is by noting which of the alloys have been melted after the thermometer has been lowered into the bore hole of the well and raised up, that the underground temperature is obtained.

When sunspots are most numerous, it is possible to use shorter wave lengths in Transatlantic radio reception.

An Army aviation expert regards 480 miles an hour as the top speed limit for airplanes, and 400 as the practical limit.

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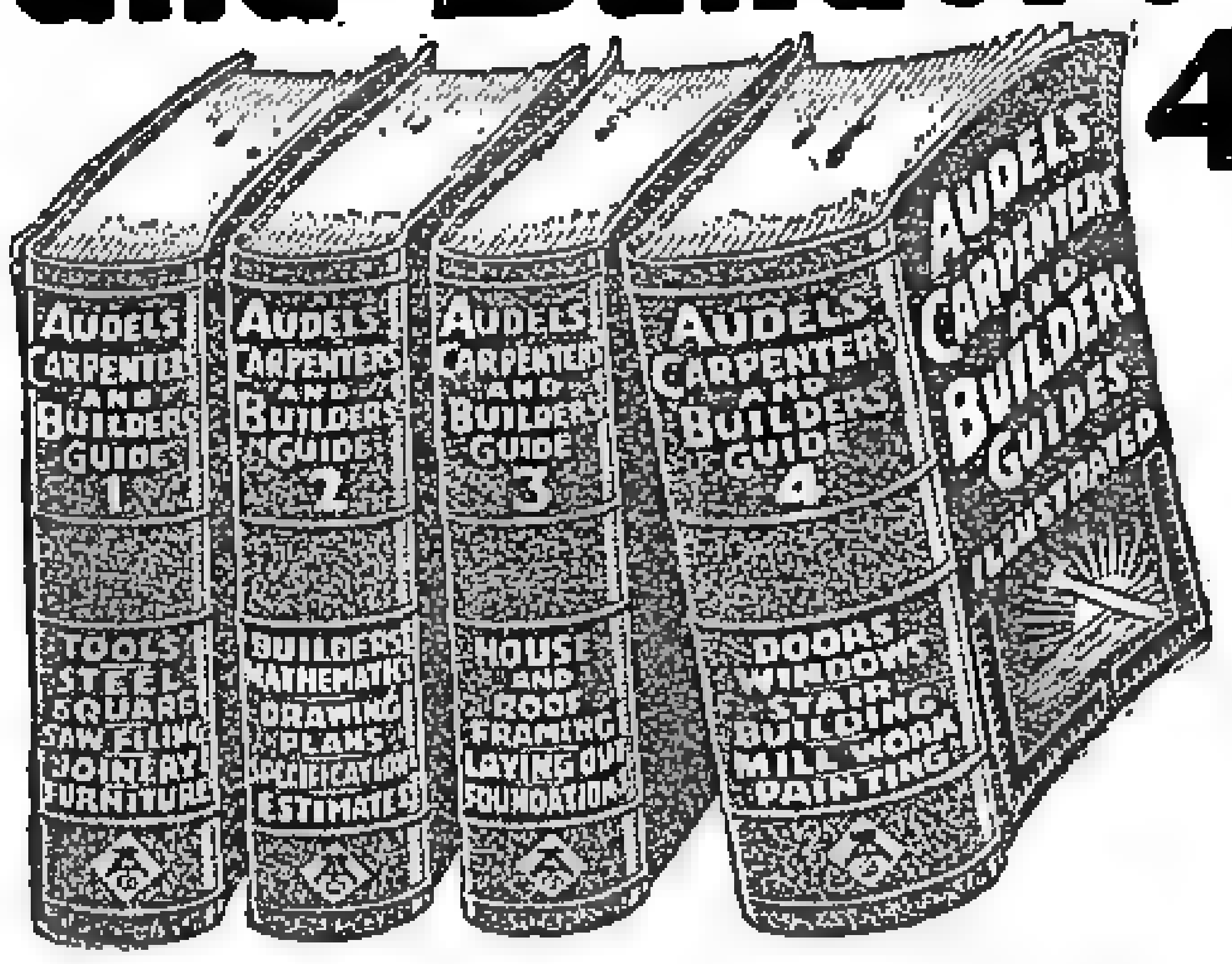
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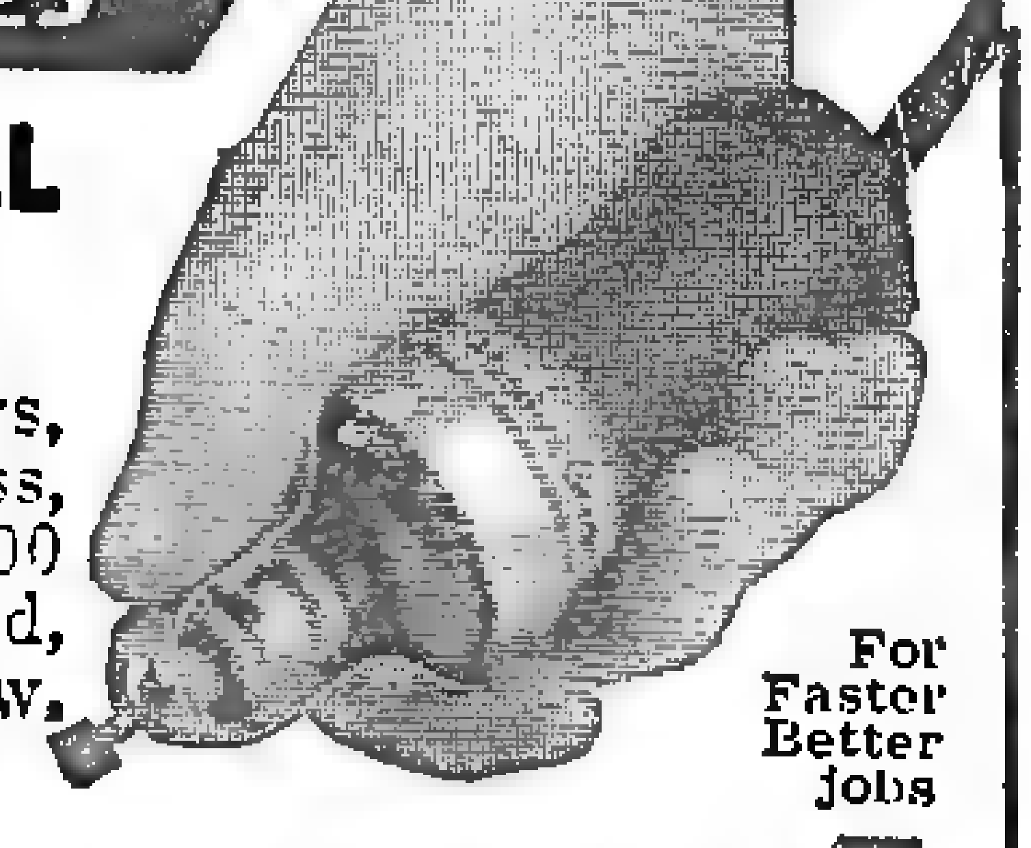

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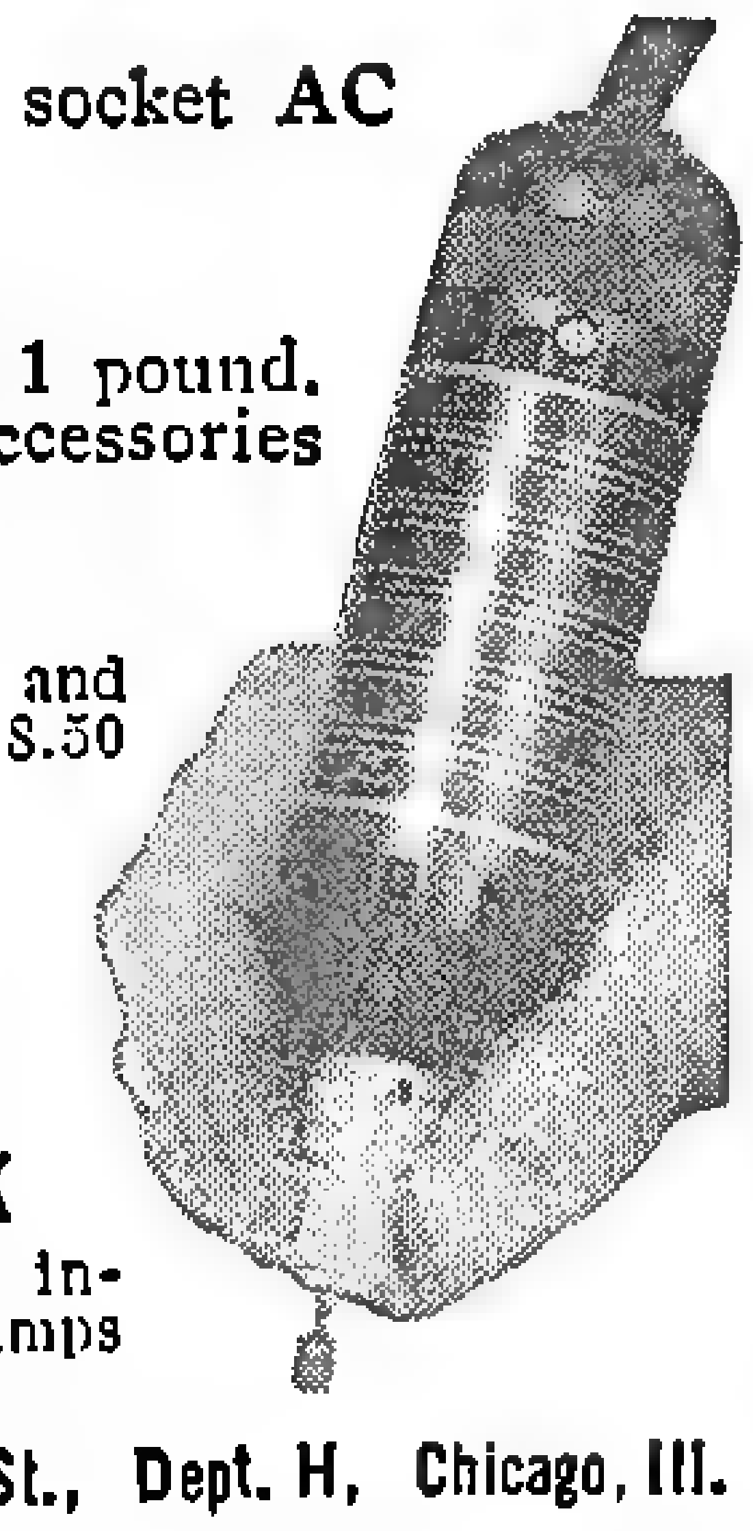

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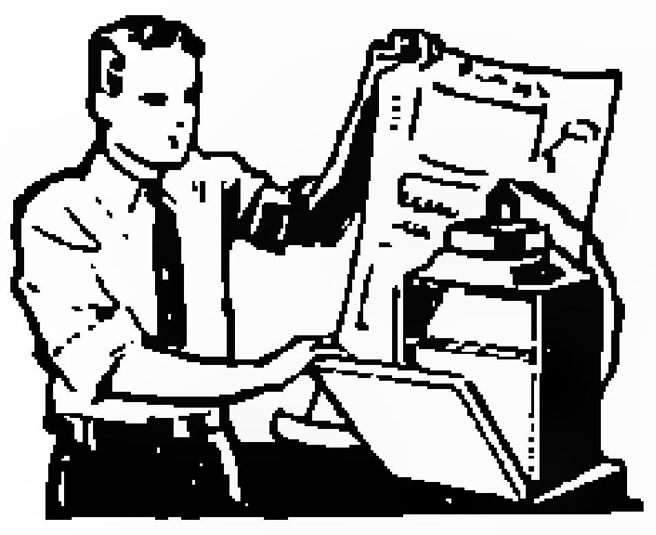

New Ideas for Home & Shop

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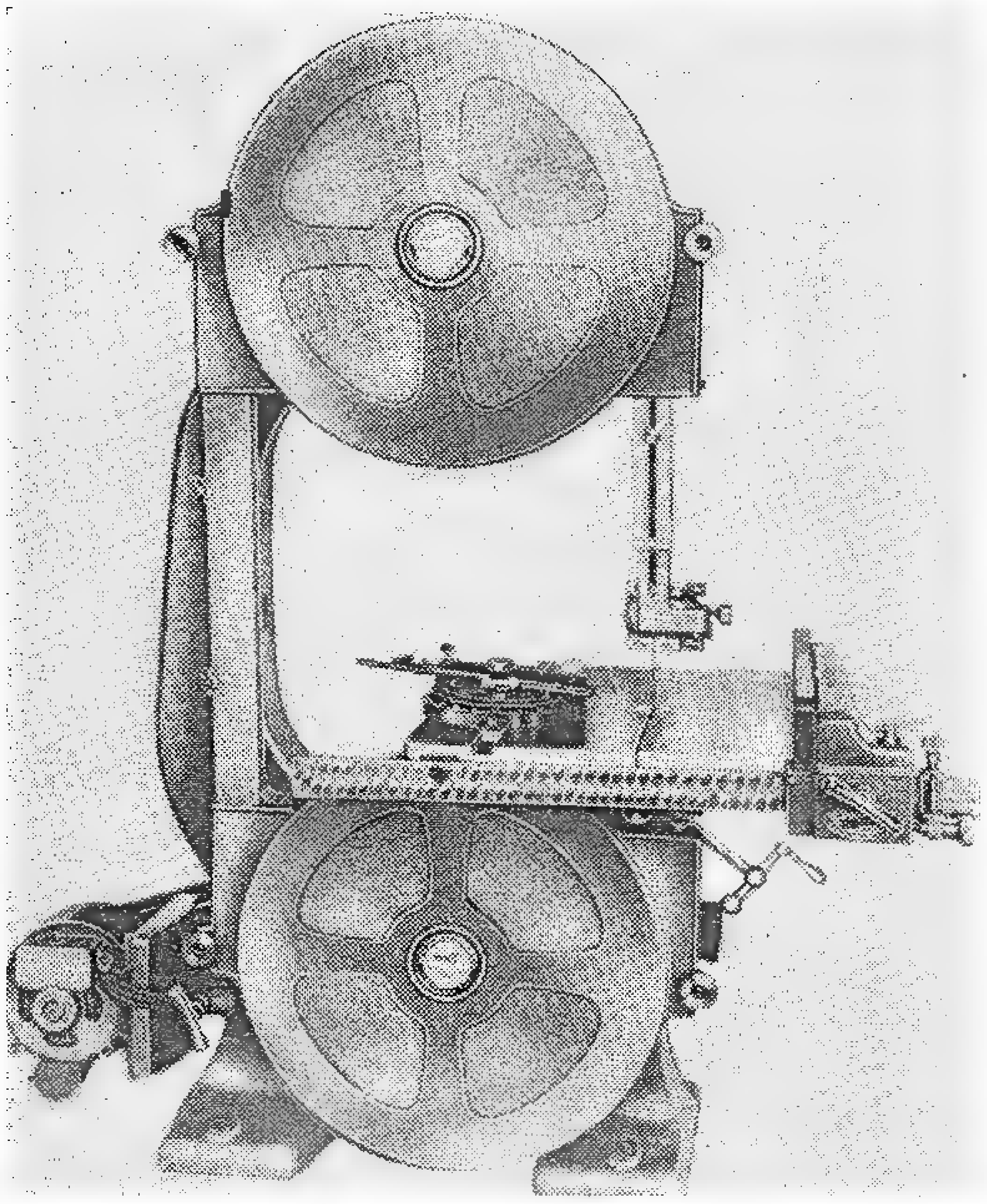
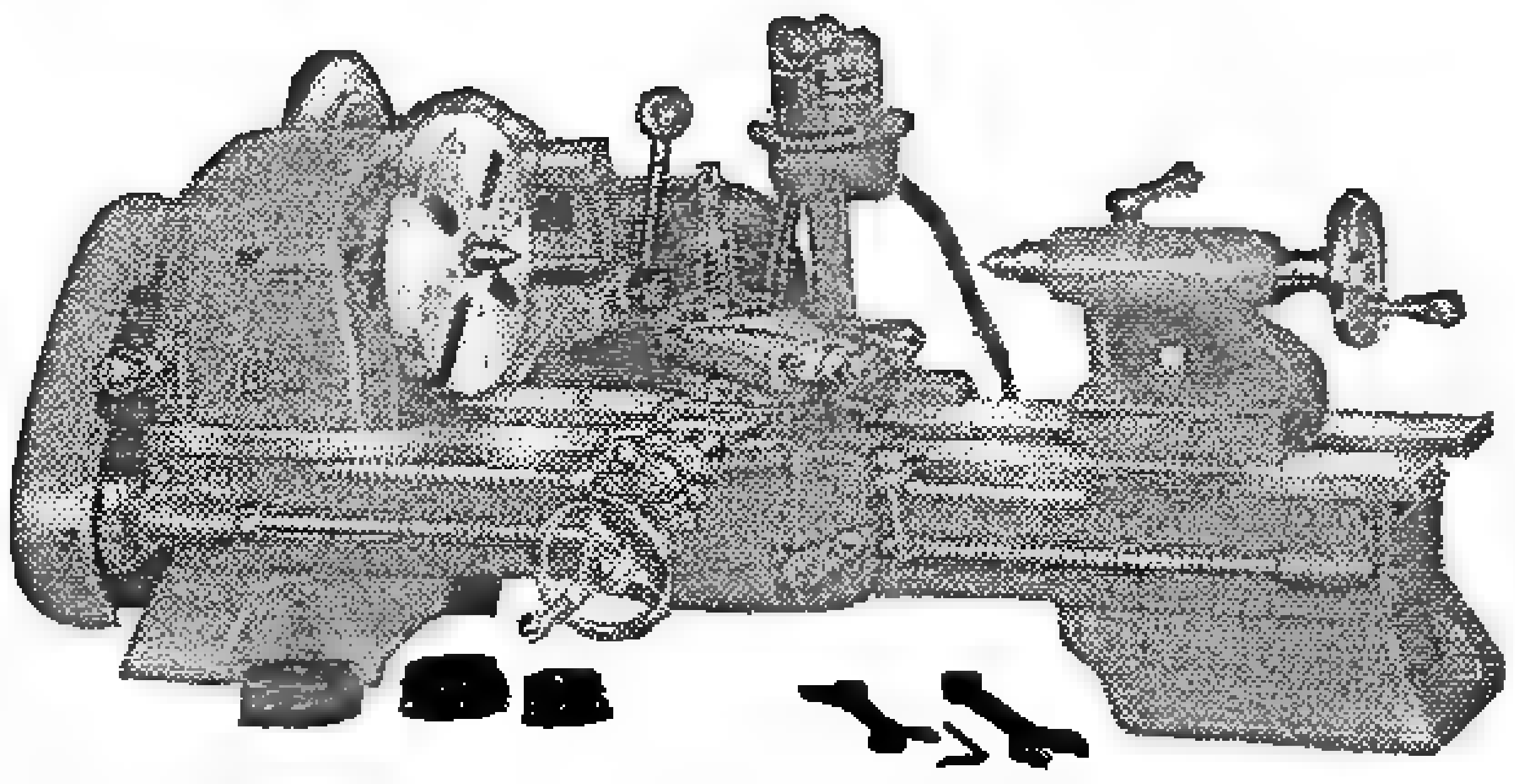


Twenty-nine thousand feet of saw teeth a minute cut through solid beams or through ordinary stock when this sixteen-inch band saw is used. Frame is hollow design, in one piece.

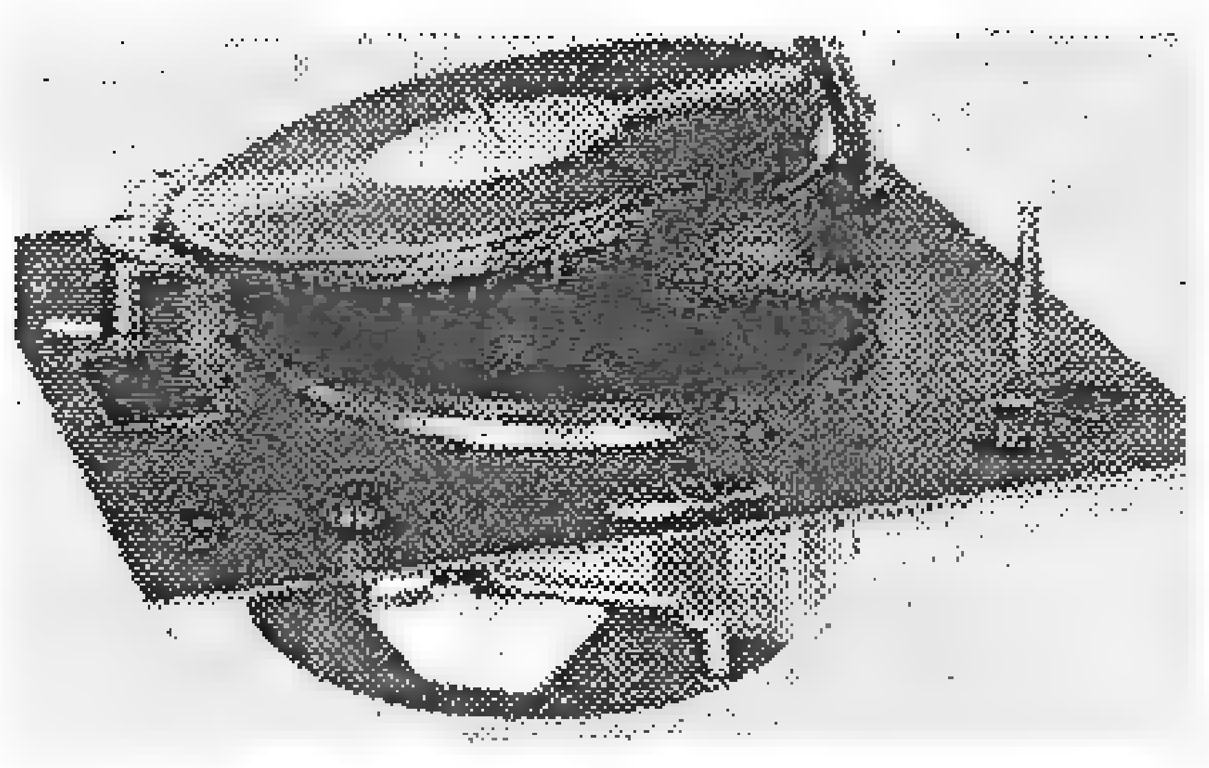
An all-purpose material for mending holes, worn spots in shoes, boots, or anything made of rubber, leather or cloth.

A concealed fire screen which disappears into the housing over the fireplace and provides protection against sparks.



This small back-geared screw cutting lathe has the constructional features of an industrial tool scaled down for accurate machining of small work in the home or commercial shop.

A non-breakable weather-proof socket. A tight fit around base of lamp prevents water, dust or gas from entering.



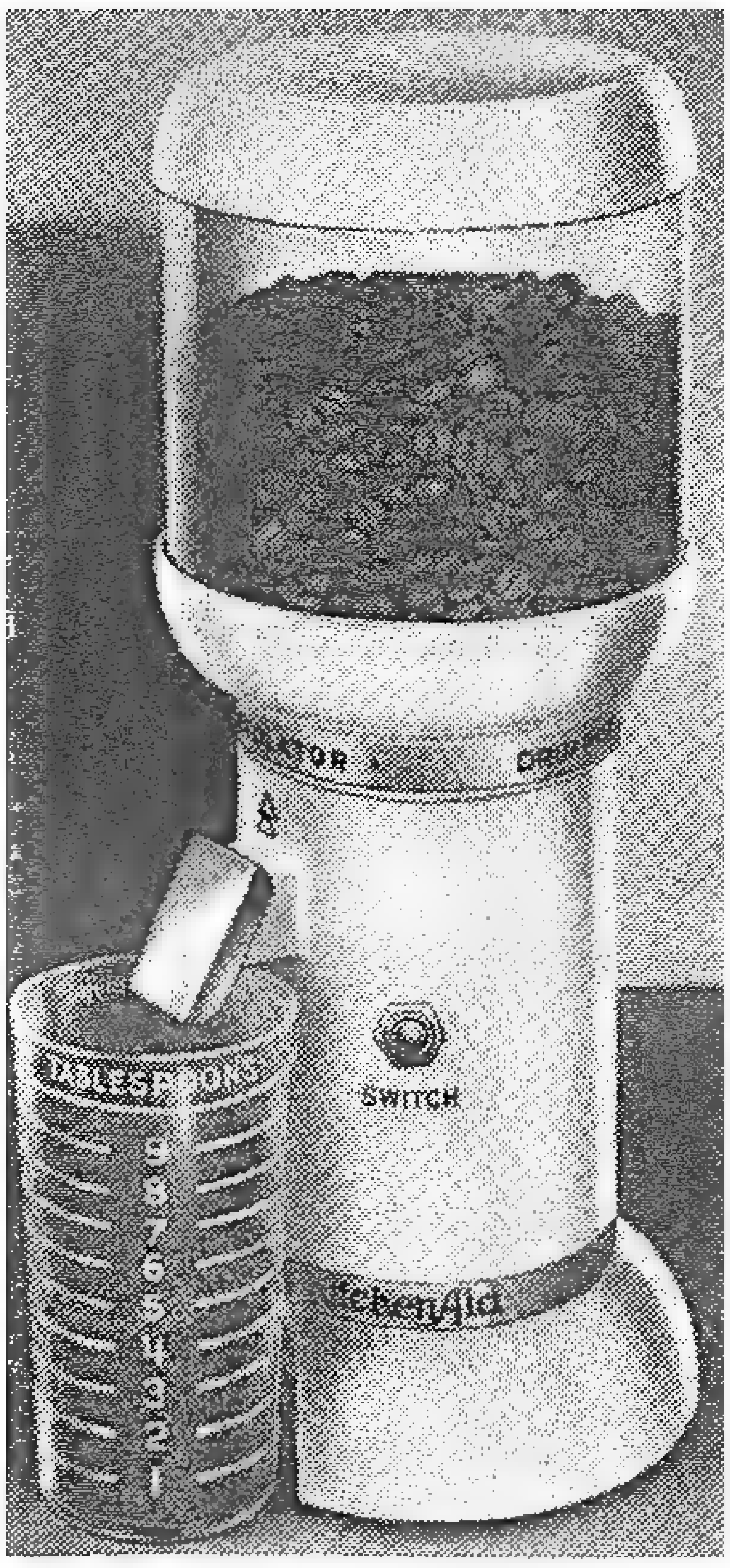
This record changer will play either eight or ten-inch records, and is available for any current.

A special tape for ammonia, brine air conditioning and refrigerating work. It is especially efficient as a wrapping for felt pipe covering.

A hand-operated lever punch. The three major parts are drop-forged and heat treated. Weighing eight pounds, the tool has an adjustable gauge for regulating the distance of the hole from the edge of the sheet.

An electric paper cutter which will cut paper of any thickness. Blades are adjustable and operate on 110 volts a. c. It will cut wet as well as dry paper.

A thread cutting screw which cuts its own threads in metal or plastics, thus eliminating a separate tapping operation.



With this electric coffee mill, freshly ground coffee is instantly available by snapping a switch.

IN NEXT MONTH'S MODERN MECHANIX

It's Here—The Radio Newspaper! While television still hides around a distant corner, "facsimile" transmission is making big strides. The new Finch machine, which is simple, rugged and foolproof, automatically delivers a continuous printed roll, bearing news, pictures, maps, fashions, etc. It is fully described in the May issue.

• • •

How Strong is Our Air Force? An authoritative answer is given by Brig. Gen. H. H. Arnold, assistant chief of the Air Corps, U. S. Army, in a vigorously-worded article of interest to every American.

• • •

Midget automobiles are the latest rage! Build one yourself in the cellar out of odds and ends of lumber and a "one lung" engine from a washing machine. Complete plans and photographs.

• • •

Spring is painting time. Do you know how to get started? Don't miss "Choose the Right Brush", a helpful, informative article.

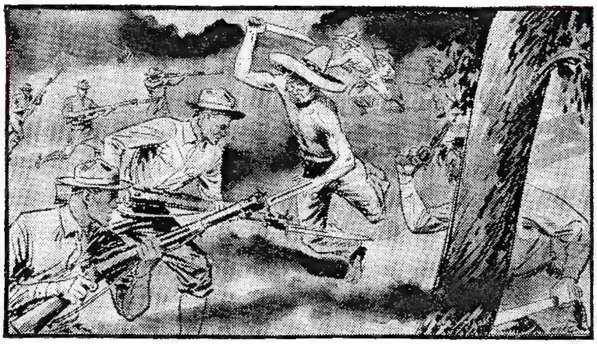
• • •

Eliminate the "bugs" from your model planes before you take them to the field. Test them in a model wind tunnel that you can put together in an evening. Every model club should have one.

—plus home, shop and garden kinks that will save you time and money, and the best photography section in print today!

"You don't have to TELL IT TO THE MARINES *they* KNOW!"

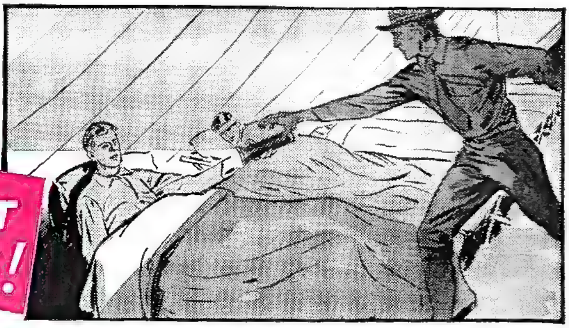
...WRITES HARRY E. REECE, FROM THE U. S. VETERANS HOSPITAL AT MEMPHIS, TENN.



"On active duty with the Fifth Marines in the Nicaraguan jungles. I went to our field hospital with fever. One day a badly injured Marine was flown in...it was my buddy!

"His head had been bashed in by a machete. To save him, surgeons must remove fragments of skull pressing on the brain...a delicate operation anywhere, it was extra tough in a field hospital. I guess they didn't have much hope. Just when they started operating...

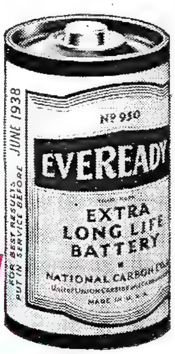
OUT WENT THE LIGHTS!



"Our small portable generator had failed! Hospital corps men rushed through the dark ward, gathered up flashlights some of the men had there, and with the light from *fresh* DATED 'Eveready' batteries, the surgeon finished his work.

"My buddy returned to duty, is still living and he thanks one *swell* Marine Corps surgeon and *dependable,* dated 'Eveready' batteries. They were the only kind our canteen sold, the only kind that could have taken what we gave 'em.

(Signed) Harry E. Reece"



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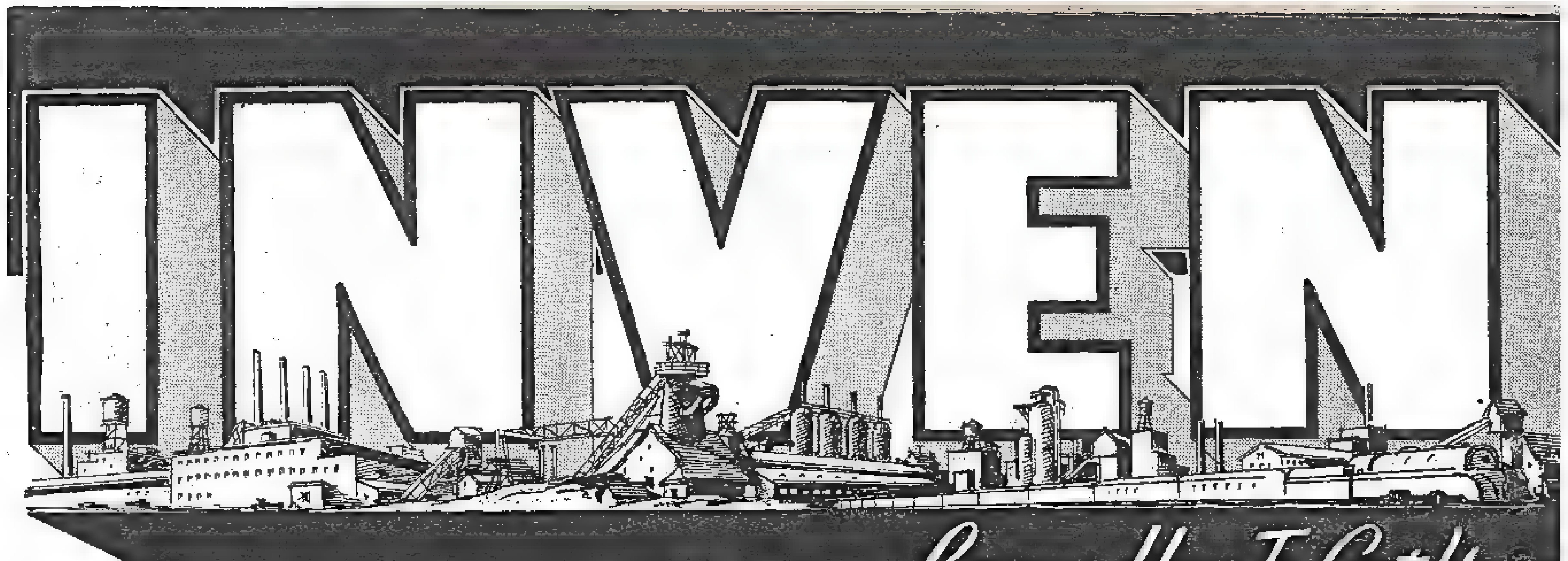

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PATENT GUIDE
FOR THE INVENTOR
CLARENCE A. O'BRIEN
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REGISTERED PATENT ATTORNEYS
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INVENTORS

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THIS FREE BOOK FROM THE CRUDE INVENTOR'S SKETCH TO THE FINISHED COMMERCIAL PRODUCT WILL SHOW YOU *Every Step of the Way*

How To Determine The Patentability Of Your Invention

Before you spend money in making a model, or spend weeks in its design, we advise you first to have a preliminary search made through U. S. Patents in the U. S. Patent Office to see if there are inventions like yours already on record; and, if so, let us give you our opinion as to the patentability of what you have.

We employ experienced searchers to perform this service for you. From the reports of our searchers we can quickly form our opinion as to whether your invention is confronted with obstacles in the form of already granted patents. First get our FREE BOOK and read the chapter on "How Can I Know Whether My Idea Is Patentable?"

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We have secured patents for inventors located in every state in the Union. Our organization is a large and efficient one. Our practice is confined entirely to Patents, Trade-Marks, and Copyrights. We have had years of experience in Patent Matters. When you place your invention in our hands, we are in position to proceed at once to secure protection for you. Our fees are reasonable, and, if you desire, we can arrange convenient terms of payment.

What Help is the Patent Attorney?

Your invention may provide your life's greatest opportunity. If it is to bring income to you it should be legally yours. Upon your patent attorney's skill rests how completely your patent covers all the protectable points in your invention. The inventor may actually lose money on his invention by overlooking a single claimable point that a skilled patent attorney would not miss.

What The Inventor Must Know

In order to proceed successfully, the inventor must follow certain definite steps that precedent has established as the quickest way to reach his goal. Our FREE BOOK, "Patent Guide for the Inventor," gives a concrete, logical, and thorough resume for the inventor to follow. It takes him, through 48 pages, from the crude first model to the finished commercial product. It shows the inventor how to avoid mistakes, how to shorten the road in getting his invention ready for market; it also points out how to save money and avoid the errors of inexperience in applying for patent. Getting our FREE BOOK should be the first step in definitely declaring yourself an inventor.

After you get this illustrated, clearly worded guide of carefully compiled patent knowledge you will know how to proceed without expensive mistakes and discouraging setbacks from "wrong-track" methods.

CLARENCE A. O'BRIEN & HYMAN BERMAN

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Registered Patent Attorneys before U. S. Patent Office

Keen competition in every form of industry has put manufacturers feverishly at work trying to speed up output, reduce overhead, save on materials, outsell trade opponents. The inventor is the key-man in making advancement possible to any business. Upon the inventor rests the success of many enterprises. This does not mean that you must have something gigantic to win commercial success. A new way to open a door or button up a shirt may be the very thing hundreds of manufacturers are looking for. If you have something novel—if it is practical to manufacture—no matter whether it be an improved rattle for a child or a whistle for a mechanical automobile, there is likely a waiting market.

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This FREE Record of Invention Form enables you to make in convenient form a sketch of your invention and have it witnessed in a manner of value to you should the occasion for evidence arise. MAIL THE COUPON TODAY and obtain our FREE BOOK and Record of Invention Form.

The Importance Of Immediate Action

In making application for patent it is important to be first. Even if your application is delayed by a few days you may be placed at a disadvantage. The short time that elapsed between Elisha Gray's application for his telephone patent and the application of Alexander Graham Bell probably cost Gray the rights to the telephone.

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A frank man to man talk about PATENTS-INVENTIONS -SELLING INVENTIONS

THE world of invention moves on. About a hundred years ago people were saying, "There's nothing left to invent"—today we know that is one of the funniest things ever said. Just think what has happened in the last hundred years! Autos, radios, airplanes, and thousands of useful, practical devices for home, shop and office have been invented and put on the market. Inventors are constantly making the world a better place to live in. Did you see a notice in the paper that an obscure worker, Hans Wach, has invented a simple device to utilize exhaust steam on steam boats. *Already, the report states, the steam ship lines have saved more than $15,000 in fuel bills with his invention.* Almost in the same breath the Dept. of Commerce announces that it will soon test out a new non-crashable aeroplane, which the average man can learn to fly in a day, which will travel at 110 miles an hour and sell at the price of a cheap automobile. An unknown Seattle man has invented a robot to go 5,000 feet under the sea and recover millions and millions of dollars worth of gold lying at the bottom of the ocean since the days of the early Spaniards.

Remember this: For every outstanding big invention there are thousands of small, simple things for use in the home, the office, the factory, on the farm, on every sort of travel conveyance. Little articles like you find on the counters of a 10-cent store, hardware store, drug store, toy and novelty shop.

Many Little Ideas Have Big Commercial Possibilities

A person finds something he's using doesn't work right, or it's clumsy, or costs too much. He gets a happy thought. He improves the old Article. That's contribution to human progress. That's the way that many, many men have reached the goal of financial comfort, independence and even wealth. Most of the things millions of us use didn't come from the brains of engineers and physicists. They came from the mind and maybe the crude home work bench of Mr. Average Man, busily engaged in earning his bread and butter at whatever chance or circumstance has given him to do. The "little" man's opportunity as an inventor was never greater than it is today.

Who Are Inventors?

You'd be amazed at the men we contact in the course of a busy year. Most of them do not consider themselves inventors at all. During their work or leisure they get an idea. They work it out on paper. They get in touch with us about Protection. Did you know that a dentist invented the stock ticker, a school teacher the telephone, a farmer the typewriter, an artist the telegraph? Did you know that the crinkly hair pin—sold by millions now—came about because a husband saw his wife twisting the old-fashioned straight hair pin to make it stay in place? **Poor men who have no thought of invention now will be financially well-fixed in a few years because of a happy thought that the world could use to advantage.**

Can You Answer These Questions?

Ask yourself these questions: How do the Patent Laws protect me? What easy steps can I take, without cost, to put myself in position to support my belief that I am the first man to think of my invention? Is a Patent worth the cost? Do I need a model? Should I try to sell my invention before I have it Patented? Is there any safe, business-like way to secure financial help? If I do apply for a Patent how shall I reach people who can market my invention? Can I protect and sell an improvement on some invention that has already been patented? These are but a few of the questions which usually confront the average man. You need the answers! **YOU CAN HAVE THEM, without cost, trouble, or delay.**

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For more than forty years, this firm has been helping men with an inventive turn of mind. We maintain a large staff of trained, experienced specialists—**Registered Patent Attorneys, Draftsmen, and Searchers to help our clients secure all the protection to which they are entitled.** Fees are reasonable. Deferred payments frequently arranged. Questions promptly answered. Write us frankly with absolute assurance that what you say will be treated with strictest secrecy. **But FIRST, send for the FREE BOOKS shown on the opposite page.** They are filled with facts, pictures and suggestions. They tell you things about Patents, Inventions and Selling Inventions that we have learned in our long experience. **They may save you time, expense, EVEN LATER DISAPPOINTMENT. Simply fill in the coupon. No charge, no obligation. Write us today.**

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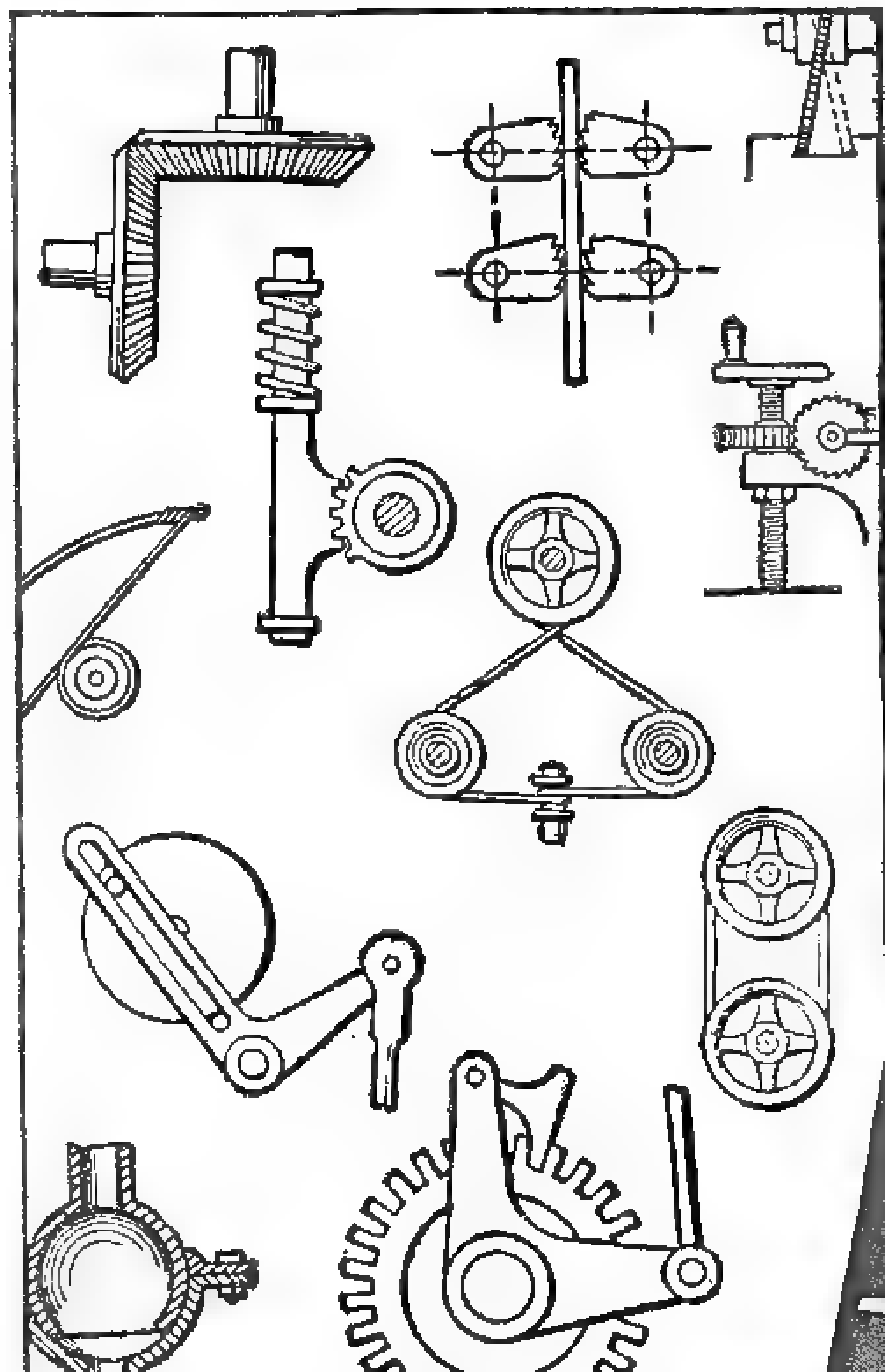

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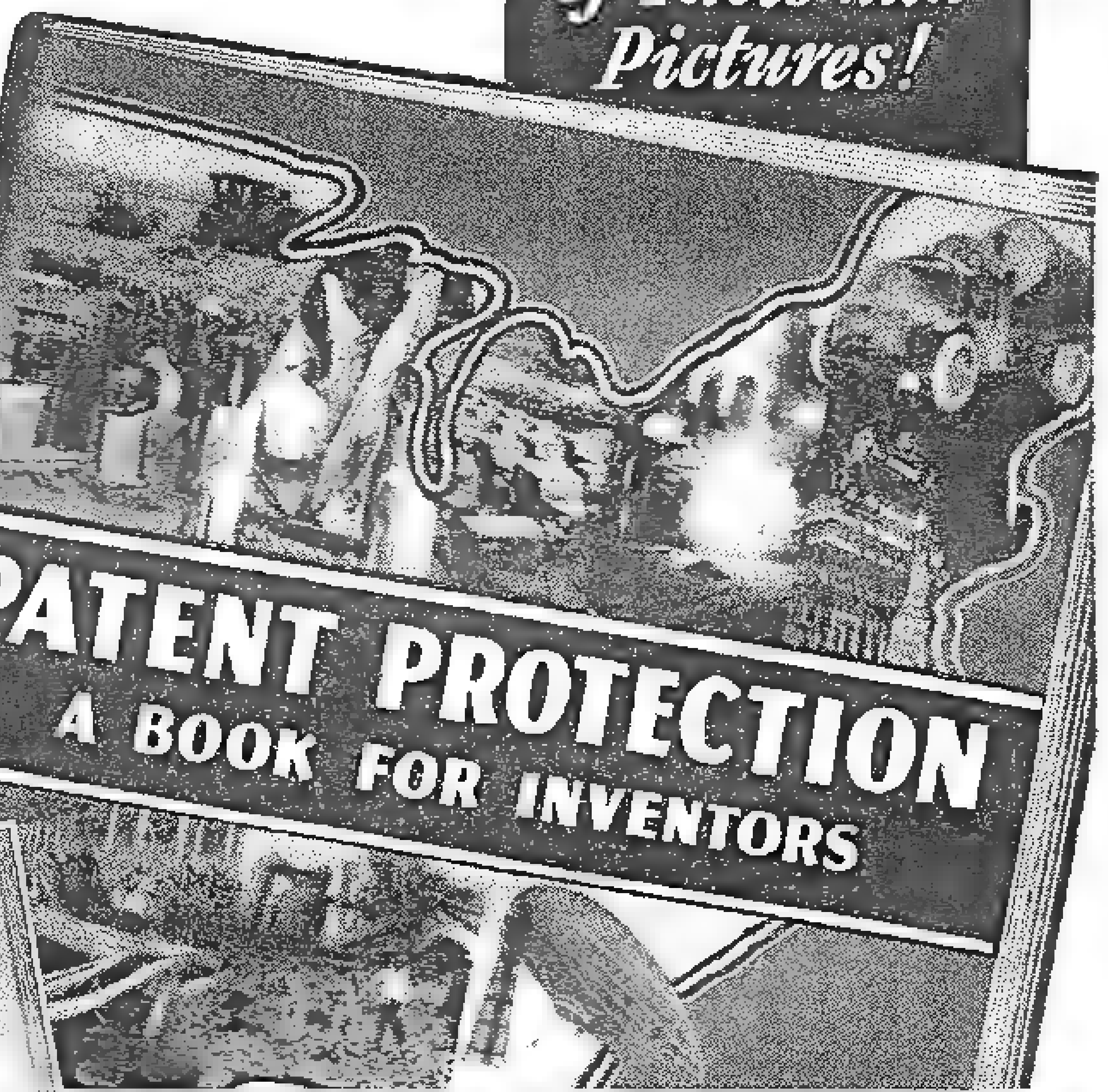

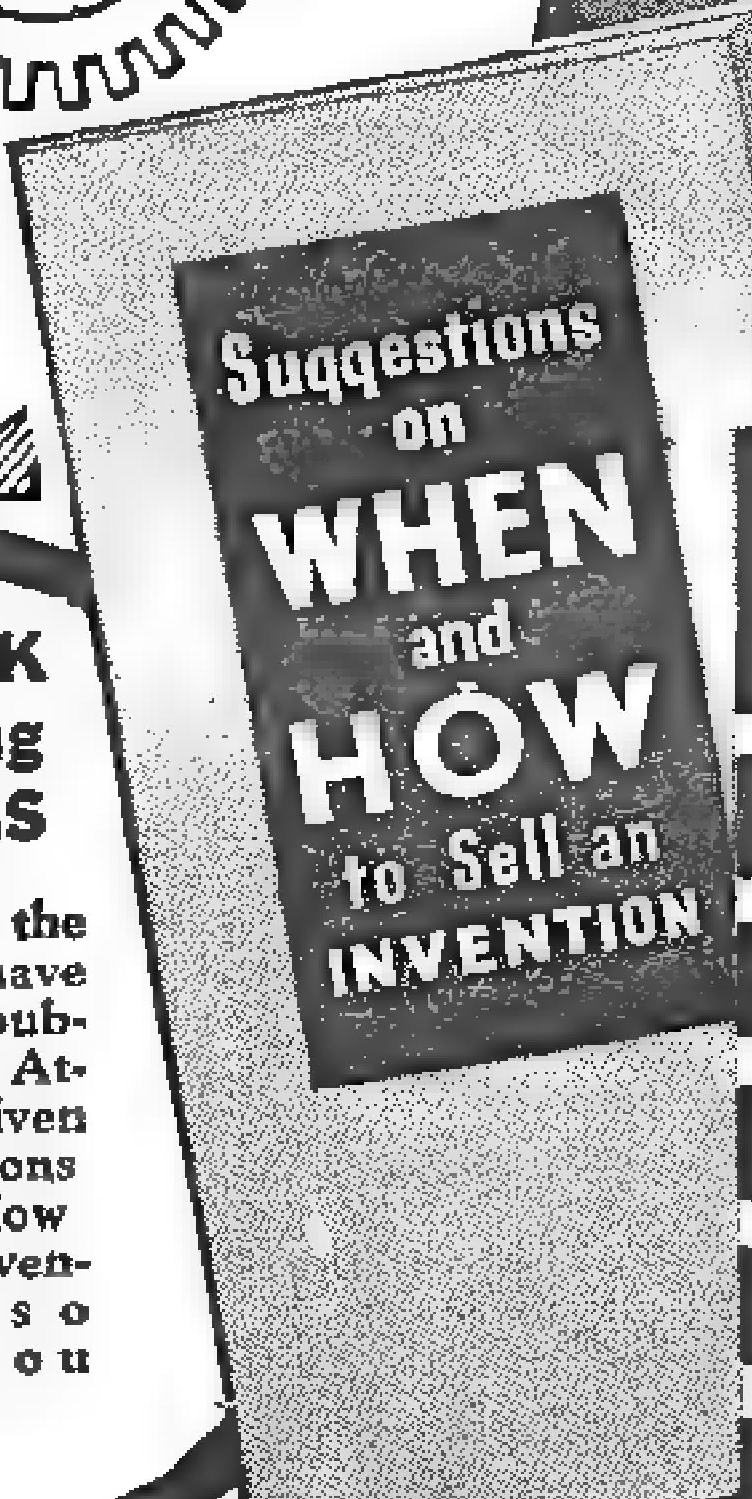

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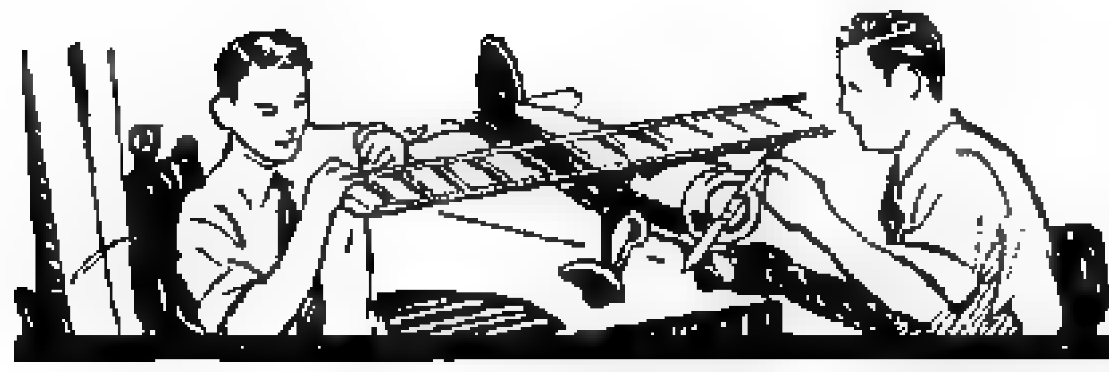
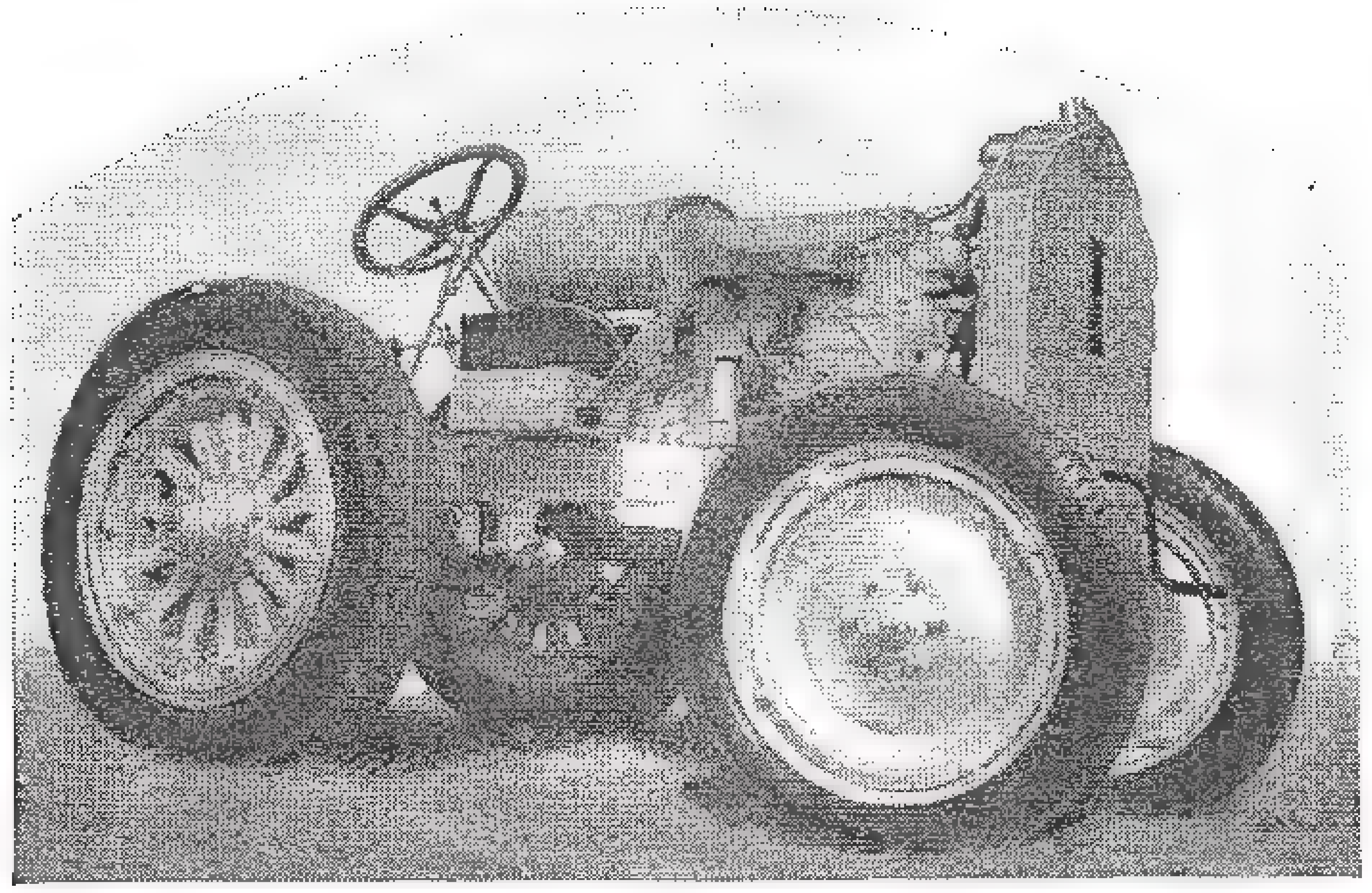


Chips from the Editor's Workbench



Built entirely from salvaged parts of old automobiles by 78-year-old M. O. Stetler, of Kingfisher, Okla., this garden tractor features six forward speeds and a one-wheel brake.

AWARDED first prize of $5 in this month's Workbench contest, a letter received from Bob Stetler, of Kingfisher, Okla., will undoubtedly interest many of our rural readers. The letter says:

> Dear Editor:
>
> Enclosed is a photo of a home-built garden tractor made by 78-year-old M. O. Stetler.
>
> The parts were all taken from discarded autos and trucks, the engine, frame and transmission being salvaged from a 1928 auto. The front axle was taken from a popular car, but was shortened and inverted to give greater clearance. The rear axle is from an old truck.
>
> The engine incorporates a centrifugal-type governor, driven by a fan belt and controlled by a choke assembly running through the steering column. Braking is accomplished by means of a lever and shoe attached to the right rear wheel.
>
> Bob Stetler

We don't know what relation Bob is to M. O. Stetler, builder of the tractor, but we certainly don't blame him for being proud of his relative's craftsmanship.

***

Midget racer fans will be interested in a letter received from Charles and Francis Dusch, of Ashland, Pa., which was awarded a prize of $3. The letter reads:

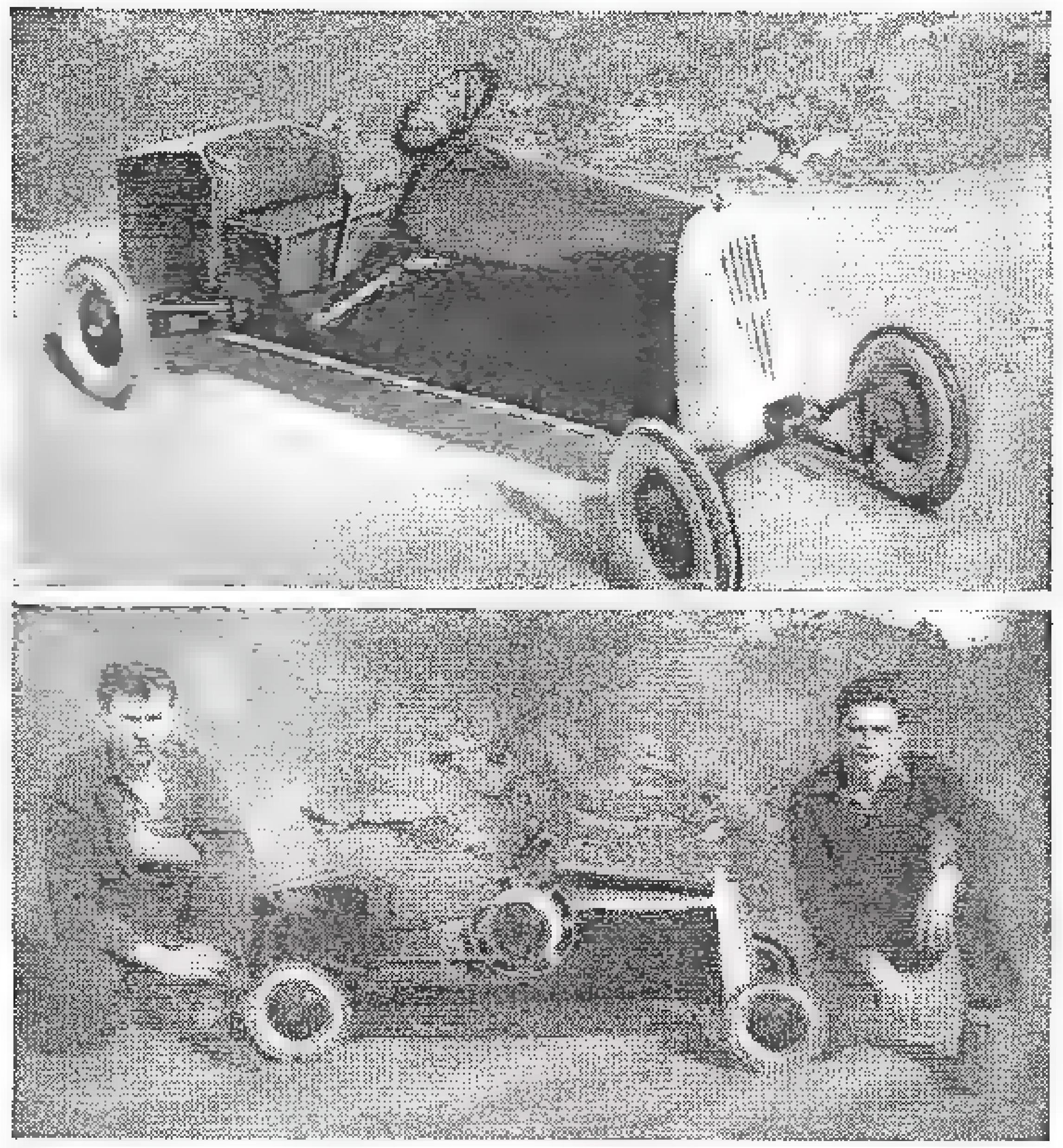
> Dear Editor:
>
> We are sending you two pictures of our midget racer. It was built from plans that appeared in MM quite some time ago.
>
> The car weighs 136 pounds and has a four-foot wheel base. It attains a speed of about ten miles per hour, powered with a ¾-horsepower washing machine engine. Due to the size of the car, we were forced to change the position of the engine, which is connected to the rear wheels by a combination belt and chain arrangement, as shown in the photos.
>
> We will gladly answer questions from MM readers if they enclose a stamped return envelope with their letters.
>
> Charles and Francis Dusch.

Here is a chance for you midget racer "bugs" to correspond with two brothers who undoubtedly are good craftsmen.

***

A letter from Howard Allen, of Hammond, N. Y., describing his home-built outboard motor boat was also awarded a $3 prize. He says:

> Dear Editor:
>
> I am enclosing a photo of "Buzzer", built from plans in the MM book—"How To Build 20 Boats". I built the boat a little heavier than called for in the book, but it goes 27 m.p.h. with a 22 horsepower outboard motor.
>
> The boat handles very nicely and I have been out during some of the strong winds that sweep the St. Lawrence River, shipping very little water. Several people have admired the boat and said they were going to send for the plans. Please print more boat plans in the future.
>
> Howard Allen.

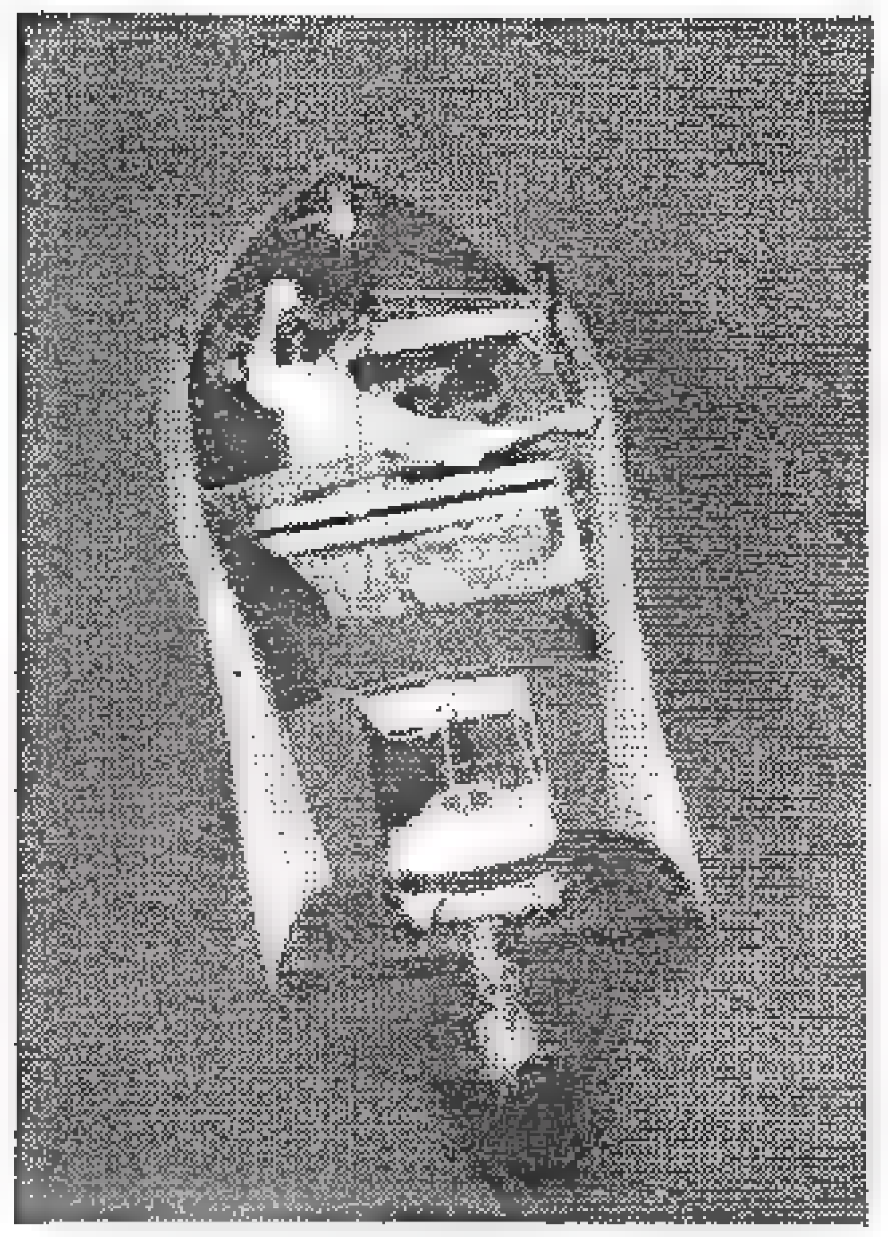


Charles and Francis Dusch proudly pose with the midget racer they constructed from MM plans. The close-up shows details of the tiny car which is powered with a ¾-horsepower engine.

Boat fans will readily admit that Allen's "Buzzer" has trim lines and the strong winds and rough water evidently proved its sea-worthiness. How about it, fans? Why not get a copy of the MM boat book (price 50c) and build a "Buzzer," too. Make summer time boating time.

***

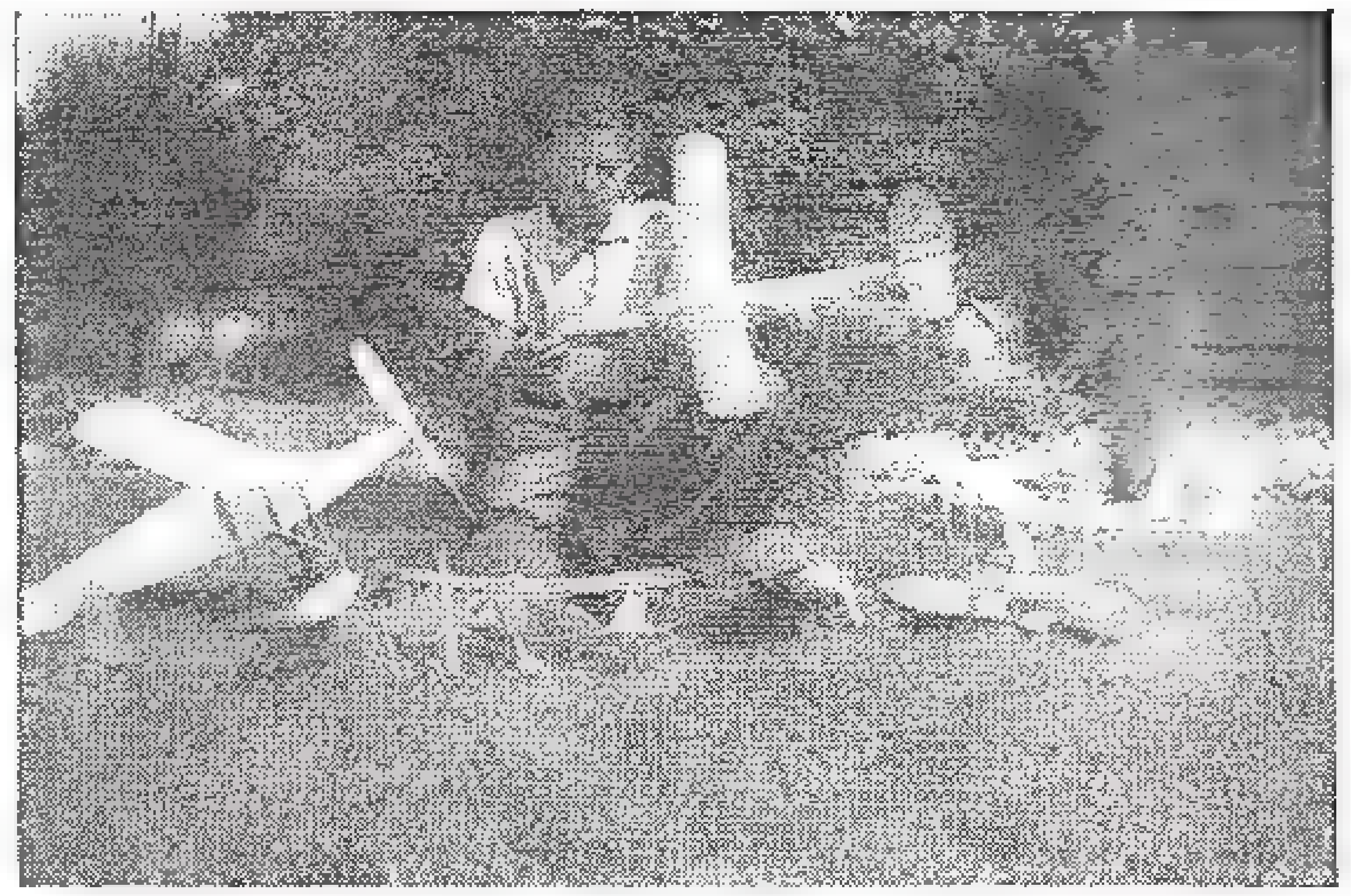
Model plane enthusiasts are usually prolific builders of solid and flying models, but how many can equal Marshall Anderson, of North Warren, Pa., who, in his letter which was awarded a $3 prize, states that he has built 35 models? He writes:



An unusual overhead view of "Buzzer," built by Howard Allen.

> Dear Editor:
>
> I am sending you a photo showing a few of the 35 airplane models I have constructed. I would like to see plans for a compressed air model in MM.
>
> I am 16 years of age and would like to hear from fellows who are interested in model plane building. Please mention this if you print my letter.
>
> Marshall Anderson

Good work, Marshall. Building 35 airplane models is quite an achievement. We are sure that other MM model plane fans will be glad to correspond with you.



Marshall Anderson, a prolific MM model plane builder, is shown here with a few of the 35 flying models he constructed.

This splendid action "shot" was sent in by Tom Griberg. It shows the MM "Sunray" sailboat he built at a cost of $84.01.

Tom Griberg, of Moline, Ill., sent in a letter which was awarded a $3 prize. The letter reads:

> Dear Editor:
>
> Most of the pictures you print of sailboats built by MM readers show the boats either moored or sailing "flat." I am enclosing a real action photo of "Sunray", an MM boat. We have found that even with a 170-pound man sitting on the low side and the water running along the top of the cockpit coaming, the boat is still stable.
>
> My "Sunray" was built in five weeks of spare time at a total cost, including sails made from airplane fabric, of $84.01. For the second season of sailing, I replaced the centerboard with a metal fin.
>
> Tom Griberg.

We try to get action photos of all boats built by MM readers, Griberg, but most of the photos submitted show the boats moored, as you say. Remember this point when sending in photos of your boats, readers.

***

An interesting letter received from Charles Fottler, of Dorchester, Mass., was also awarded a $3 prize. His letter reads:

[*Continued on page* 31]

Certainly we would defend Alaska.

Then there is the Panama Canal which, in addition to its enormous commercial advantages, saves us the expense of maintaining two fleets. We would fight to prevent the canal from being destroyed or falling into foreign hands.

And the Hawaiian Islands! We would never permit a foreign power to seize them and thus establish an important base off our Pacific Coast.

Getting out of the realm of fact, into that of political speculation, would we enforce the Monroe Doctrine in case of an aggressive move by a foreign power in either Central or South America?

Would we feel obligated to defend the Philippines, shortly to attain their independence?

Would we defend our trade and citizens in foreign countries or traveling on the high seas?

Would we again attempt the role of defenders of democracy throughout the world, as we did in 1917?

The continental limits of the United States are not in much danger of being invaded—as long as we have our fleet, now the second largest in the world.

The time may come when an invasion by air is possible, but we need not worry about that now. Planes can now fly the Atlantic in one jump, but none can make the round trip, carrying a worthwhile load of bombs one way. Any troops that could be flown across could be handled by the local police.

Invasion of the United States, it is generally conceded, would have to come by sea. And no such invasion would ever be attempted as long as our fleet was in existence, unless it should be caught in the wrong ocean and held there by destruction of the Panama Canal. The Canal, for this reason, needs to be made impregnable. Its present defenses consist of a mobile brigade to repel landing parties, our air force, anti-aircraft artillery, and coast defense guns, which are adequate to protect it from a raid (unless it should be a surprise raid made before a declaration of war). Its major defense is the Navy itself, which alone can prevent a major operation against it, since such an attack would have to be made by sea. It could, however, be effectively blocked by the simple expedient of blowing up a ship passing through it (which would have to be done before a declaration of war).

A second canal, the projected one through Nicaragua, would be an excellent defensive investment, far less costly than building a second fleet, or attempting to expel an invader once he had a foothold. But a fleet cannot remain afloat indefinitely. It must have bases where it can retire for repairs, refueling and to replenish its ammunition supply. Such bases must be strongly defended by anti-aircraft and coast defense guns, and a land force strong enough to repel surprise raids aimed at their destruction. We have four such bases at New York, Norfolk, Puget Sound and Pearl Harbor. We have an undefended base at Guantanamo Bay, Cuba, which should be fortified, for it is vital to the defenses of Panama. Since the Key West—Havana route is the line of supply for Guantanamo, Key West should also be strongly fortified. We also need another base on the west coast. Complete docking facilities are all that is necessary to make San Diego such a base.

It has been frequently asserted that a navy is obsolete, since an airplane bomb can sink any ship. This has yet to be proved, for no first line battleship has ever been sunk by an aerial bomb. In the Battle of Jutland, 50 capital ships hurled big caliber shells at each other for hours, yet only one battleship was sunk (there were 24 other ships sunk, but all were cruisers or lighter craft). A 14-inch shell and a one-ton bomb are about equal in destructive effect, the shell having a greater armor-piercing quality. Long-range shell fire falls almost vertically, and decks are armored to withstand such fire—there is no reason to suppose they cannot stand up as well against bombs. A well-placed bomb can, of course, sink any other type of ship.

The submarine battleship controversy is in the same category. No capital ship has ever been sunk by a submarine. Battleships have "blisters" (false sides) below the waterline to explode torpedoes before they can do serious damage, the hulls are minutely subdivided as well to localize the damage of any penetration. Besides, battleships never operate without their protecting screen of destroyers, which, with their hydrophones, depth bombs, and great speed, are more than a match for any submarine.

So the Navy needs battleships because they are the only type of ship that can fight other battleships. It needs cruisers—fast long range ships—to fight off lighter craft, and to scout and locate the various components of the hostile fleet.

The Navy also needs destroyers as protection against submarines, to make fast torpedo attacks against the hostile line (too many torpedoes, just as too many shells or bombs will sink even a battleship), and to lay smoke screens in front of the big ships to prevent accurate, aimed fire from the enemy's surface craft.

Because of such smoke screens, as well as because of the extreme range of big guns, battleships must have airplanes for

Realizing the value of aircraft as fighting and scouting auxiliaries, the U. S. Navy has added another carrier, the *U. S. S. Yorktown* (below), to its fleet. Circle—Taking off from the flight deck of the *U. S. S. Lexington.*

Although it is claimed that submarines have never sunk a capital ship, their ability to observe enemy ports and coasts unseen while operating against merchant marine vessels has resulted in the building of more underseas craft by foreign nations, as well as by the United States. One of Uncle Sam's submarines, the *P-1*, is shown below. Circle—Obsolete World War equipment is still used by the U. S. Army Signal Corps for training purposes due to lack of modernized apparatus.

spotting their own shell fire. To protect the spotting planes, fighting airplanes are needed, and for this reason we must have enough airplane carriers to transport these planes, which can also be used for bombing and scouting operations in co-operation with the fleet.

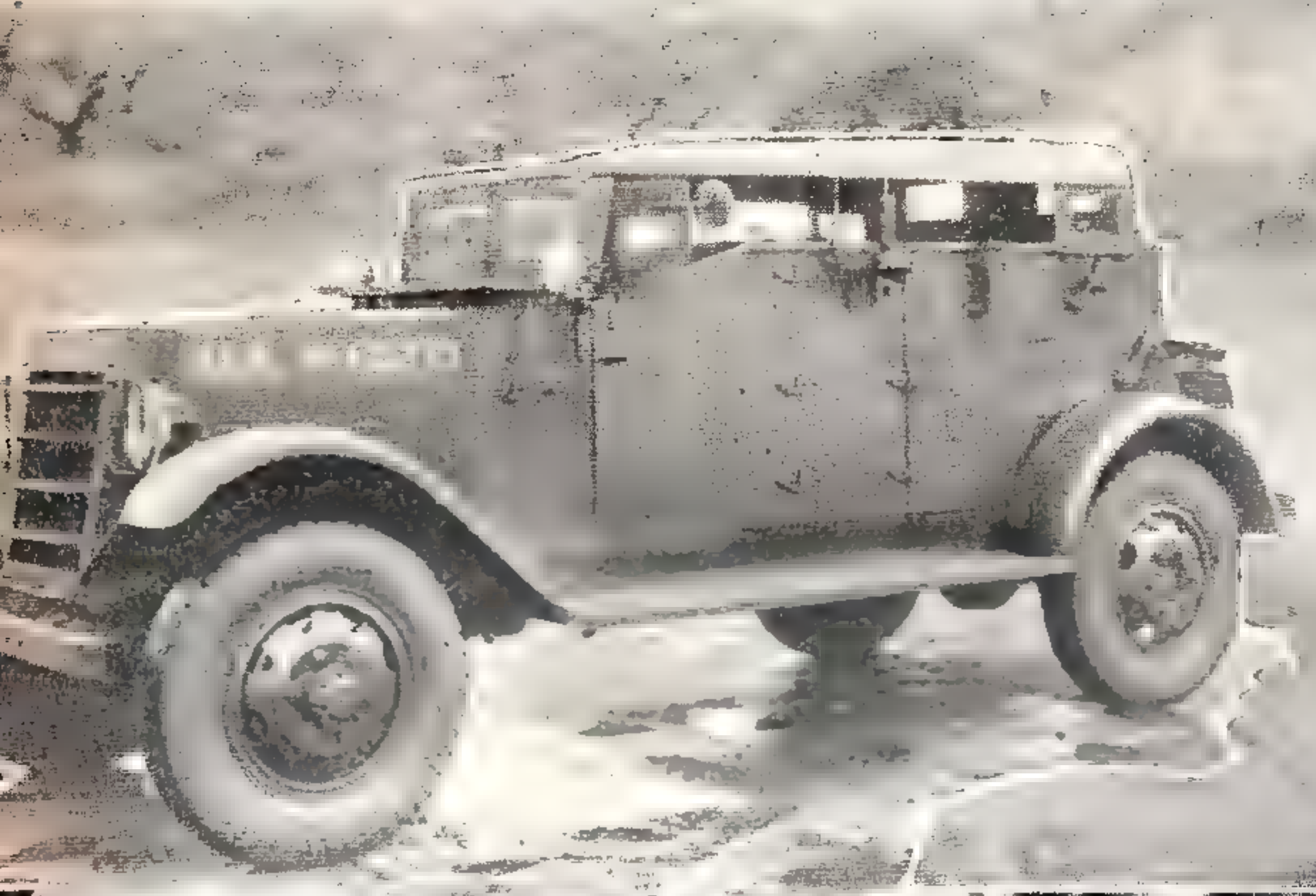
Although submarines aren't much good in fleet operations, they are needed for observing enemy ports and coasts unseen, for helping to locate the enemy fleet, and for operating against lone ships of inadequately protected convoys.

Various types of auxiliary ships, such as airplane, destroyer and submarine tenders are needed. Such ships operate with the fleet and are capable of performing almost any repair, no matter how great, for the craft they are designed to service. Other ships, such as oilers, ammunition ships, store ships, ocean tugs, hospital ships, mine-layers and mine-sweepers are also needed. Our Navy is said to be particularly deficient in these auxiliaries at present.

Any one or several of these types of ships could be dispensed with, if other naval powers dispensed with theirs, but to be deficient in any one type would invite defeat in case of war. There is no such thing in warfare as second prize. You either win or lose. Our Navy should be strong enough to win within its own operating range. This operating range is the distance from the base in which it can operate as a complete unit, and is limited to the range of destroyers, which is 2,500 miles.

Though the Navy is the first line of defense, we cannot afford to depend upon it alone. Should it be defeated, should it be afloat in the wrong ocean through the blocking of the Canal, or should we be attacked simultaneously by a European and Asiatic power, we would have to count on our other arms.

The Air Corps would be the first to see action. Highly mobile, our entire fighting force could be assembled at one point within 24 hours. In an action near our shores the long range bombers (of which we now have the best in the world) could patrol the seas, either alone or in conjunction with the Navy. Having discovered an approaching force they would attack with bombs, but it is doubtful if the Air Corps alone could prevent a landing, either on our own shores or in adjacent Canada or Mexico. A landing force would then have to be expelled by adequate forces representing all service arms.



Used for reconnaissance by officers, armored cars like the one shown at left are helping to modernize our army. However, great numbers of these cars, as well as other mechanical equipment, is needed to fully modernize the Regular Army.

●

Supported by aircraft and naval operations, this battery of 155 mm. general purpose guns (lower left) would play an important part in defending Hawaii in event of war. Below—Not a man from Mars, but a soldier with a new type gas-proof suit.

Much more likely than this sort of a war, though, is an invasion of Alaska or the Philippines. There is little question that we would fight in either event, yet we are now inadequately prepared to resist such an invasion. Our Naval base at Hawaii is 5,000 miles from Manila and about 2,000 miles from southern Alaska.

If we plan to hold Alaska, we need a naval operating base at Dutch Harbor, and an Air Corps base farther inland, with the necessary coast and anti-aircraft defenses, plus enough ground troops to resist any landing attempts near these bases.

We do not need a large army, but the one we have should be highly trained, and equipped with the best weapons available. While our Springfield rifle is the best military rifle in the world, the fire power of the infantry could be increased five times, by equipping them with semi-automatic rifles. We now have only 3,000 such rifles. We should have at least 50,000.

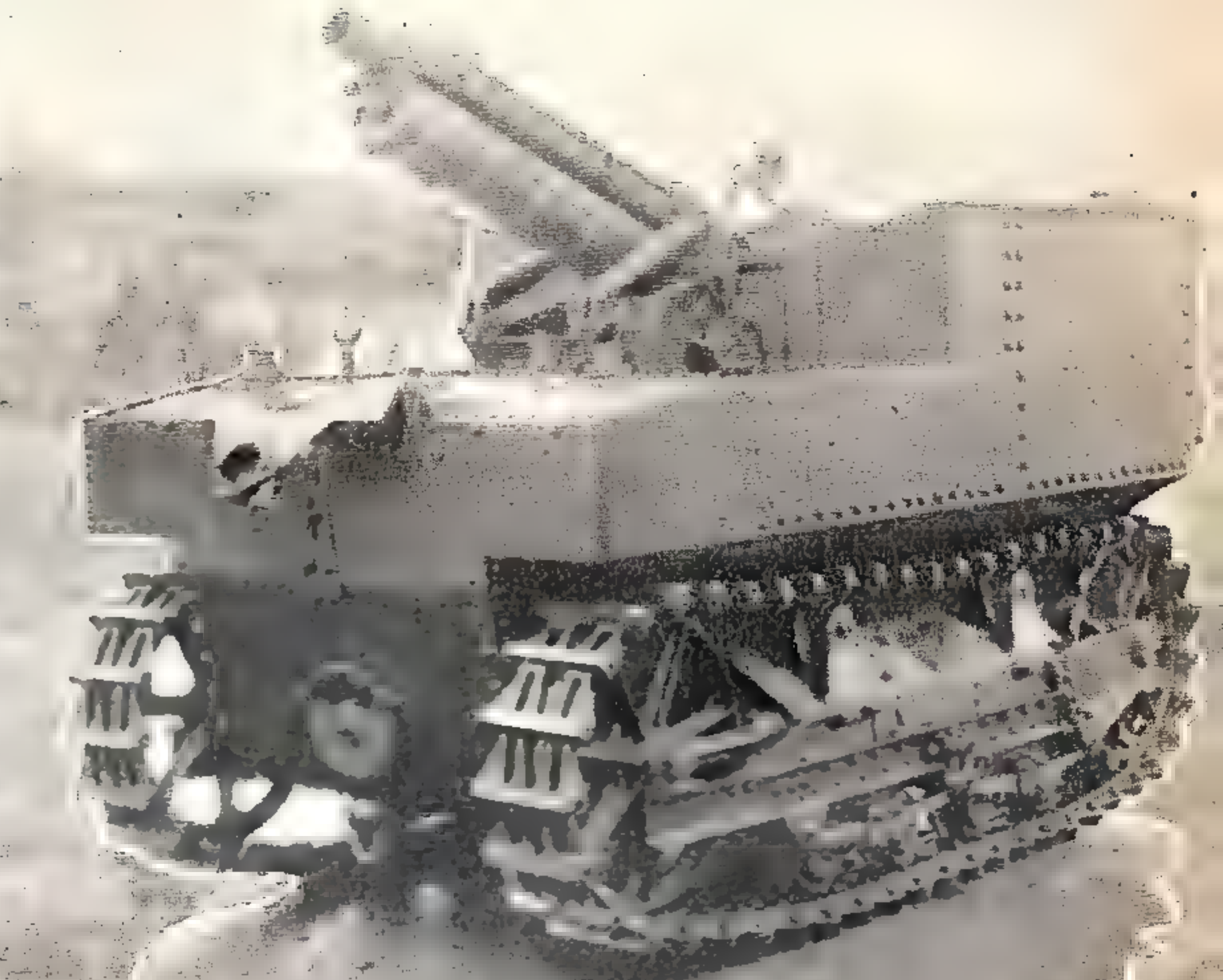
Until recently our Army had only six modern tanks—not nearly enough for training purposes. This amazing deficiency has been remedied, but we still need more. Two hundred would be a conservative minimum in view of world affairs.

We have four thousand '75's left over from the World War. An excellent weapon in its day, we have since developed a field piece that weighs the same, yet fires twice as far; and it can be towed at fifty miles an hour behind trucks. The old wooden-wheeled gun is damaged if towed faster than eight miles an hour. We need to equip our regular army artillery units with these modern guns and this is rapidly being done.

Anti-aircraft artillery, surely a defensive weapon, has been wonderfully improved since the World War. We need to equip our anti-aircraft Regular and National Guard regiments with the latest in these types of defensive weapons.

In short, all of our Regular Army and National Guard units should be supplied with enough of the latest equipment to enable them to take the field at once, as a modern force. There will be time enough to equip a large wartime army while we are training the men, but our permanent force should be the best trained and best equipped force of its size in the world. Only if it is so can we afford to keep it small. There should be enough ammunition of all calibers in reserve, to last our regular forces for 30 days.

[*Continued on page* 118]



Designed to provide artillery support for advancing infantry, 75 mm. howitzers mounted on caterpillar-tread trucks (upper right) can follow the troops even though the ground is torn up by shell fire. As part of our defense plans, it is urged that factories manufacturing mechanical military equipment be encouraged with sample orders in order to keep production machinery and tools on hand.

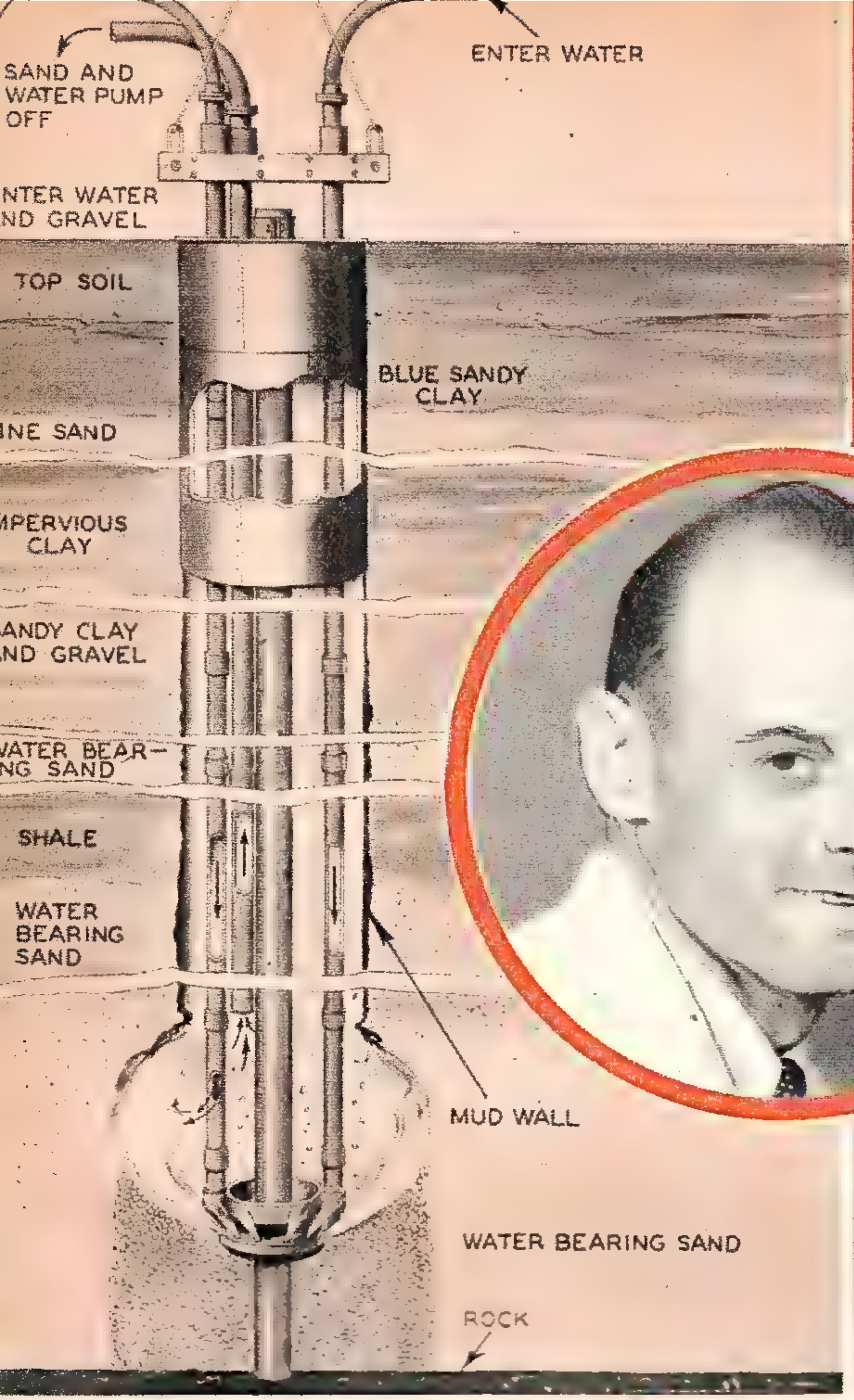
●

The mobility of aircraft has made them an important part of the defense plans of the United States. Shown at the right is a formation of Boeing "flying fortress" airplanes in flight over New York City. Powered by four 1,000-horsepower engines, a squadron of these bombers recently demonstrated their ability to speed to the aid of any section of the country by making a transcontinental flight in eleven hours and two minutes.

WATER Treasure Hunting

by John L. Coontz

Deep-well digging ranks as one of the most marvelous of 20th century engineering feats.



Cross-section drawing showing construction of a deep-well reamer. Its operation is fully described in text.

Circle—Paul Sweitzer, who is rated as one of the world's foremost authorities on modern scientific deep-well digging.

YOU probably have been thrilled by stories of the big game hunters of the world, by the experiences of horror and death in the frozen North; you may have shuddered over the escape of adventurers penetrating the depths of unknown forest jungles, surrounded by tropical disease, deadly insects and poisoned, hostile arrows, but have you ever thrilled to the story of that tiny stream of water which comes trickling from the tap in your bathroom—the romance of finding it and bringing it into your home?

Roughly a third of the people of the United States use underground water. The agricultural and industrial uses of it are enormous. Daily these uses are growing and modern methods of searching out this water, guaranteeing an ample supply at all times, are among the most marvelous of twentieth century engineering accomplishments.

Imagine, if you can, a 60-inch hole running straight down into the earth for a distance of 400 feet. Sixty inches in diameter means five good feet of earth. In this circular space four men could stand with comfort. But more than this. Imagine, at the bottom of this black shaft a great mass of earth mowed out, a huge pit created, and created neither by hand or steel shovel. Imagine the filling up of this pit or hole again with gravel and stone from the earth, packed symmetrically and in accordance with certain engineering specifications.

"Modern deep-well digging accomplishes this—and more," says Paul Sweitzer, one of the world's foremost scientific deep-well diggers. Mr. Sweitzer has dug wells for the Federal government in Washington, giving to the great St. Elizabeth's Hospital in that city, millions of gallons daily of the purest water in the world; for the cities of Savannah, Georgia, Houston, Texas, Annapolis, Maryland, Jamaica, Long Island, St.

No wonder Mr. Sweitzer (wearing hat) and his assistant are smiling—the water pouring from the pipe during a test indicated that the new well in the background would yield two million gallons daily.

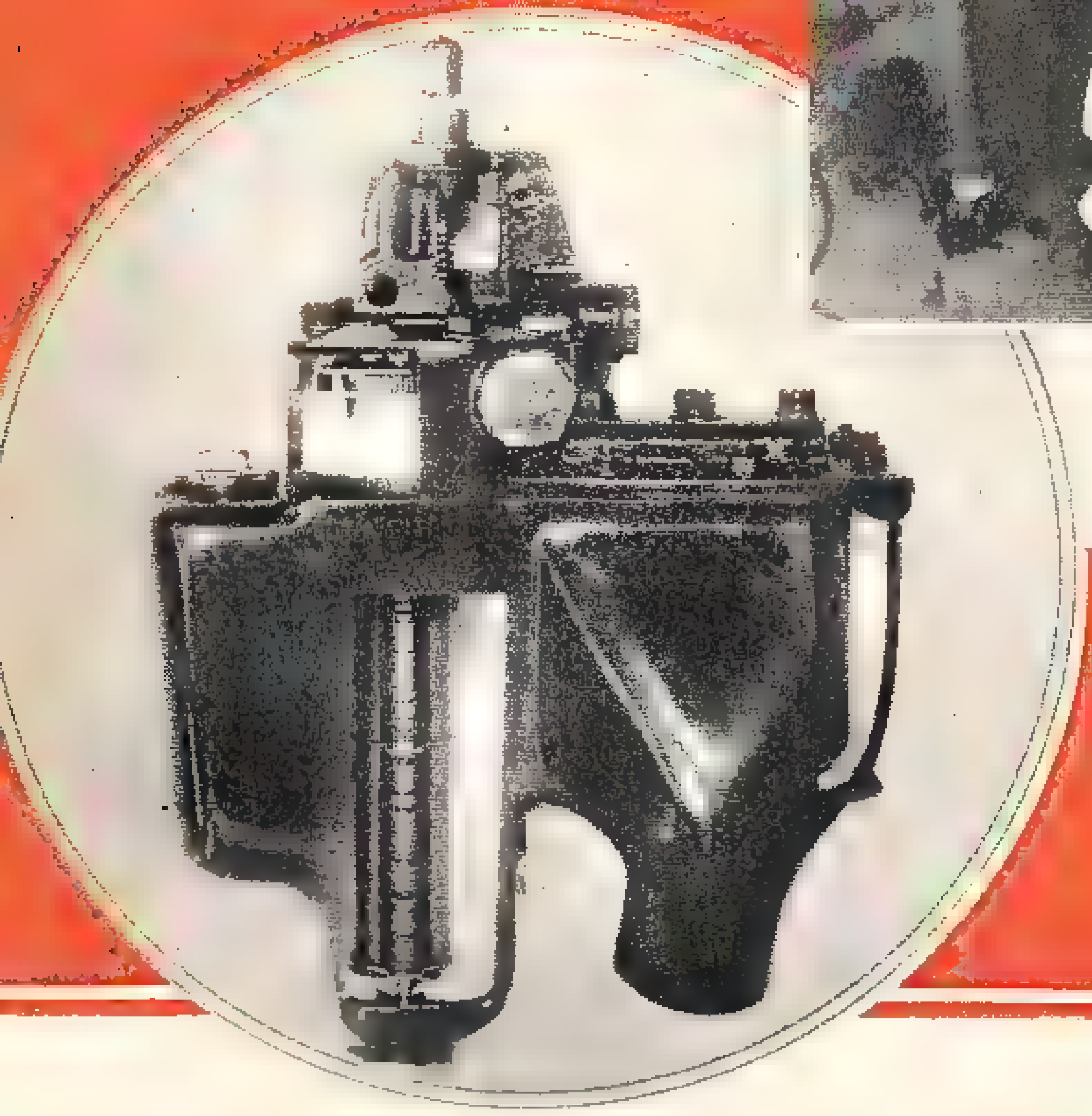
No, this is not an oil well, but—a deep-well being "flushed" by forcing water into its depths by means of a hydraulic reamer fitted with jets. Right—A huge slab of clay that became wedged between the cutting blades of the reamer.

The installation of self-cleaning oil filters, such as the type shown below, enables fleet owners to save hundreds of dollars annually in reduced oil bills alone, to say nothing of the savings in engine wear and tear. Some filters feature renewable clarifier cartridges which keep the oil so clean that many operators instruct their drivers to change oil only every 5,000 to 8,000 miles.

Have your car tested regularly with modern equipment (above) if you want to keep repair bills down and efficiency up at economical operating levels.

Applying the suggestions made in this article may reduce your auto operating costs as much as 50%.

Bus line operators regularly check their vehicles for wheel misalignment (right) because they know it causes premature tire wear and faulty braking.



FOLLOW THE FLEET

by Frederick C. Russell

HOW would you like to cut the cost of operating your car from 25 to 50 per cent? Or do you think that is an idle dream?

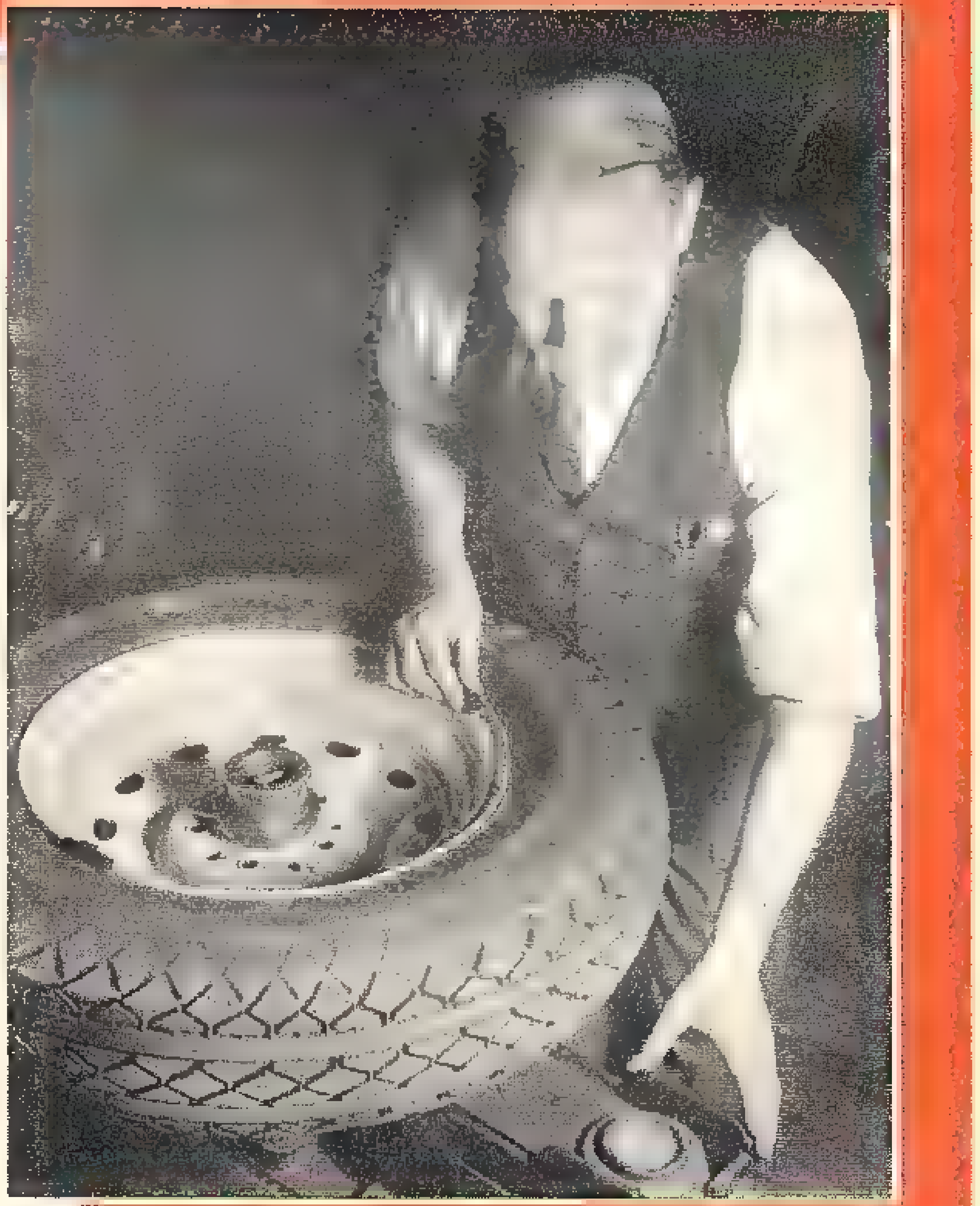
Believe it or not, this pleasant reverie can come true, if you will merely put your motoring on a business-like basis. It is a matter of adopting the sort of management that is helping large companies save sizeable sums in the operation of their traveling employees' cars, trucks, buses etc.

Follow the fleet owner, if you want to enjoy more miles to the dollar. His rules are fairly simple, yet they produce results that seem incredible. The fleet owner does not think there is anything exceptional about the lowered cost of operating his cars. He expects it. The savings are yours, too, if you will handle the subject as you would your own business.

By rotating tires (switching from one side of the car to the other, and shifting the rears to the front in a counter-clockwise direction) it is possible to double their life. One firm found that by insisting that their men rotate tires every 6,000 miles, working in the spare, mileage jumped from the usual 15,000 to 30,000 or more. Tests showed that, although in some cases it was better to switch tires in the way I suggest, it was the mere changing of the tires that produced the real savings. A tire that stays in one position too long may be punished for any irregularity of the brakes or misalignment of the wheel on which it is mounted.

Since bringing all of its cars under one management the motor vehicle department of an eastern state has raised gas mileage four miles per gallon in individual cases. Tests show that most carburetors are adjusted too rich, providing extra acceleration which drivers do not actually need. Operators are being educated to realize that in emergencies better acceleration can be obtained by dropping into the modern fast second gear. In many cases it is found that the automatic choke is not properly adjusted, or that it isn't working properly. Drivers also are cautioned against allowing the engine to idle for warming up purposes where an automatic choke is used. Under such conditions an engine merely loads up, not only wasting gas but diluting the engine oil as well.

Since 1928 the operating cost per mile for several hundred cars operated by an insurance company has dropped from 8.6 cents per mile to 3.4. This has been accomplished despite the fact that the company uses a large percentage of cars which do not provide high gas mileage. The management was unable to lower the cost materially until it discovered that there is a very definite period beyond which it is more economical to trade in for a new car. This point is found to be just before the owner is faced with the necessity of having major repairs performed on the car and can

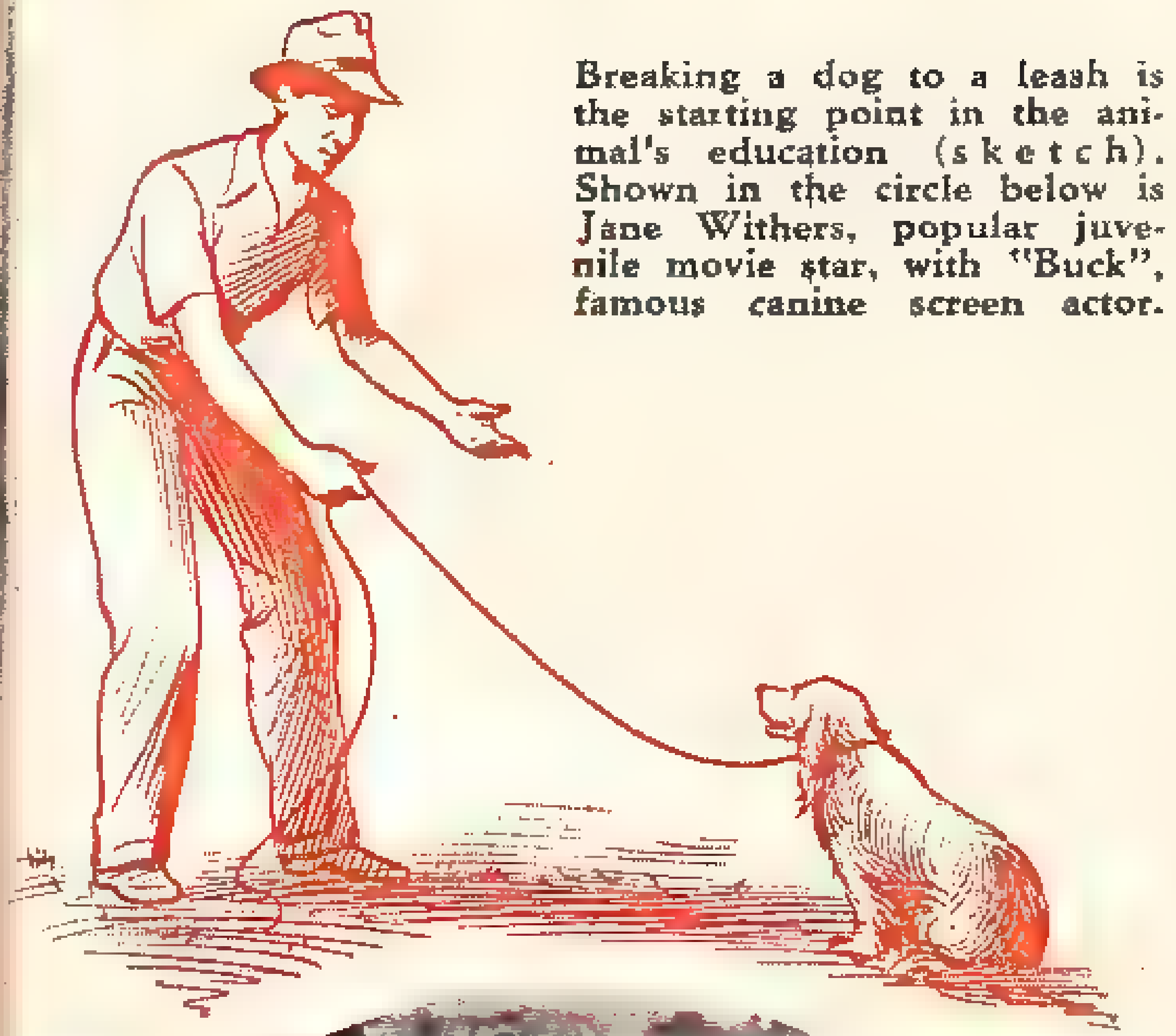


Unbalanced wheels may easily cause rapid tire-tread wear and front wheel "shimmy," so thrifty drivers check them regularly.

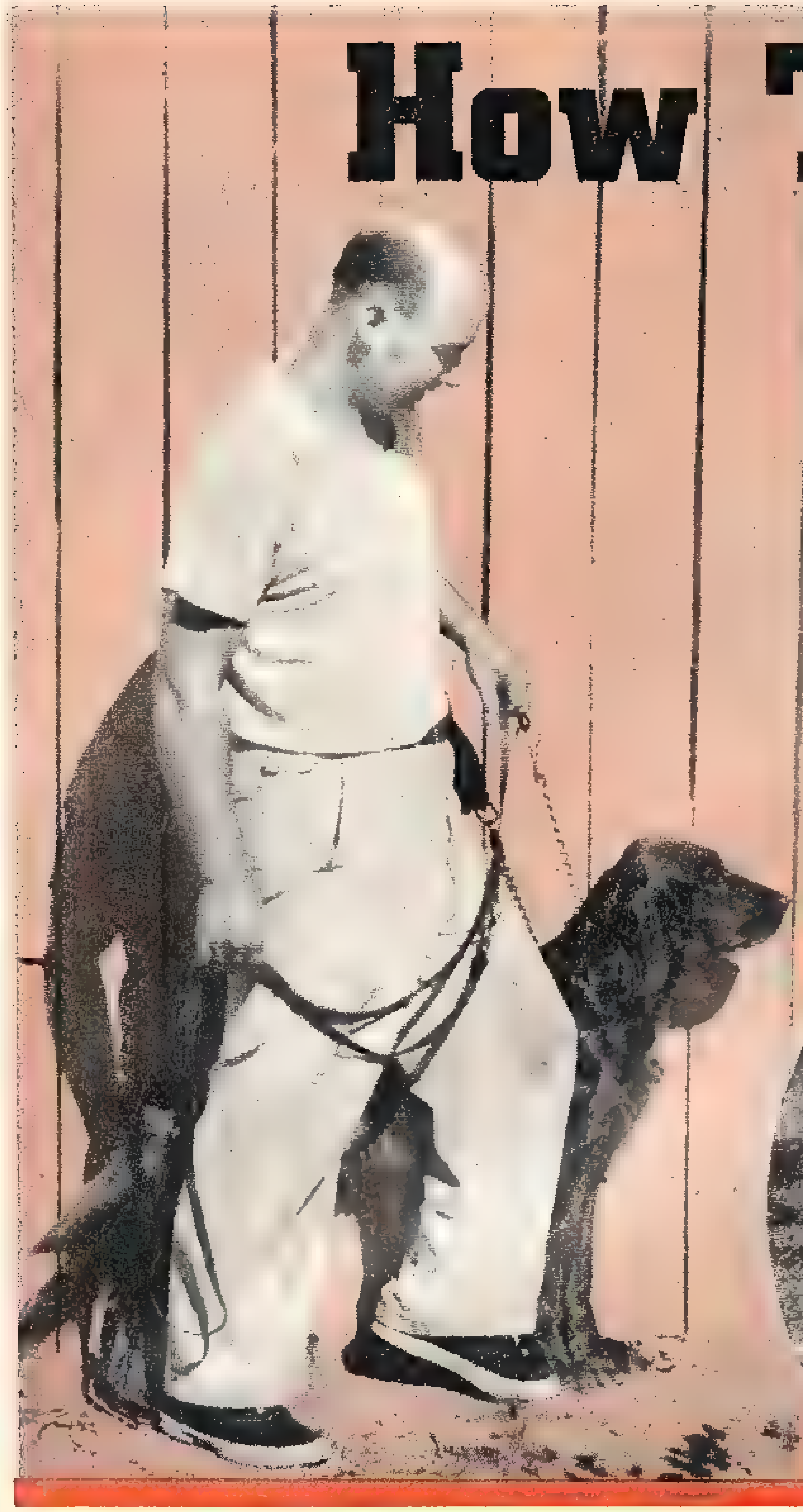
How To Train Your Dog

by Marty Soden

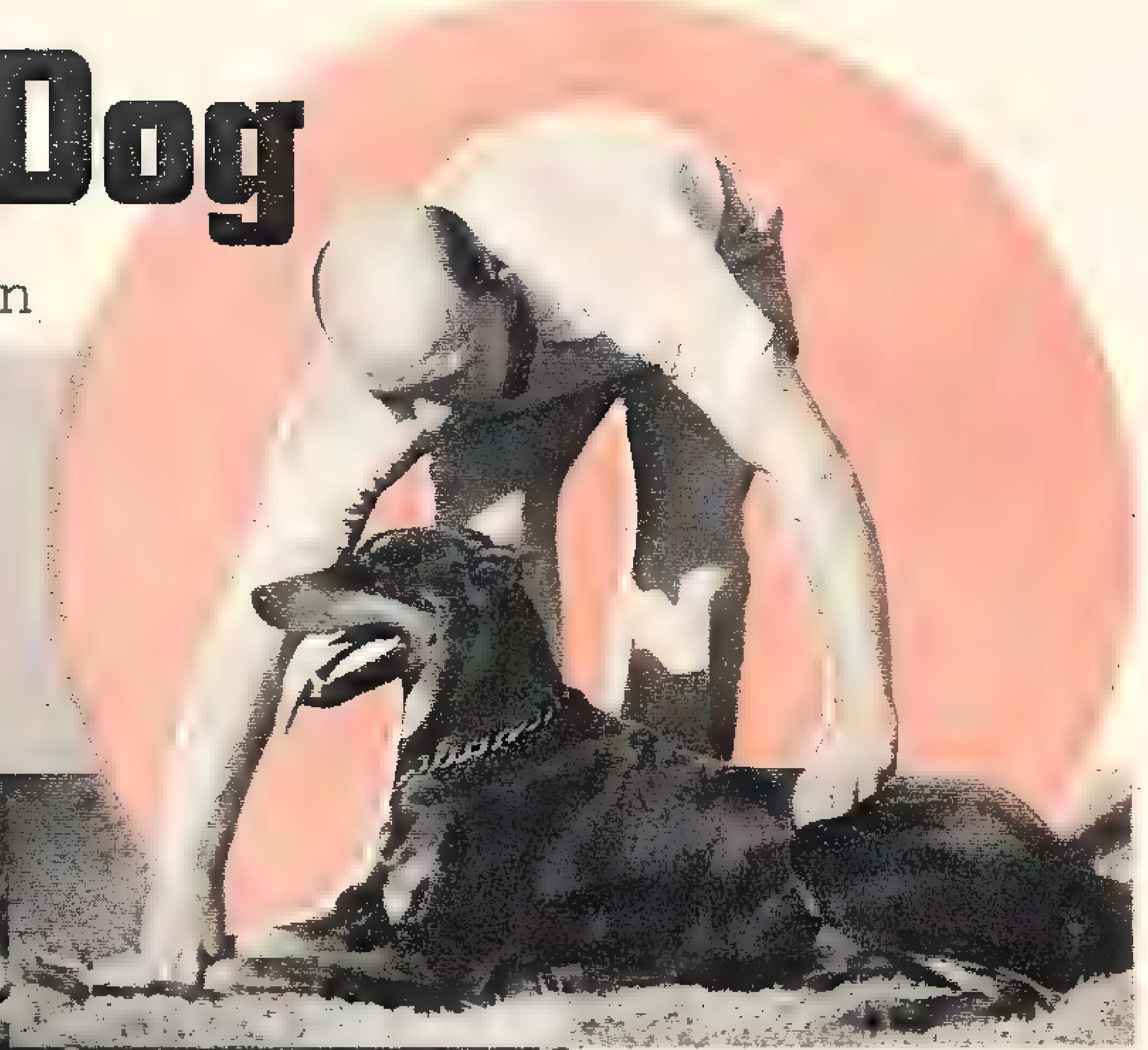
Daily lessons will make your dog an obedient pet.

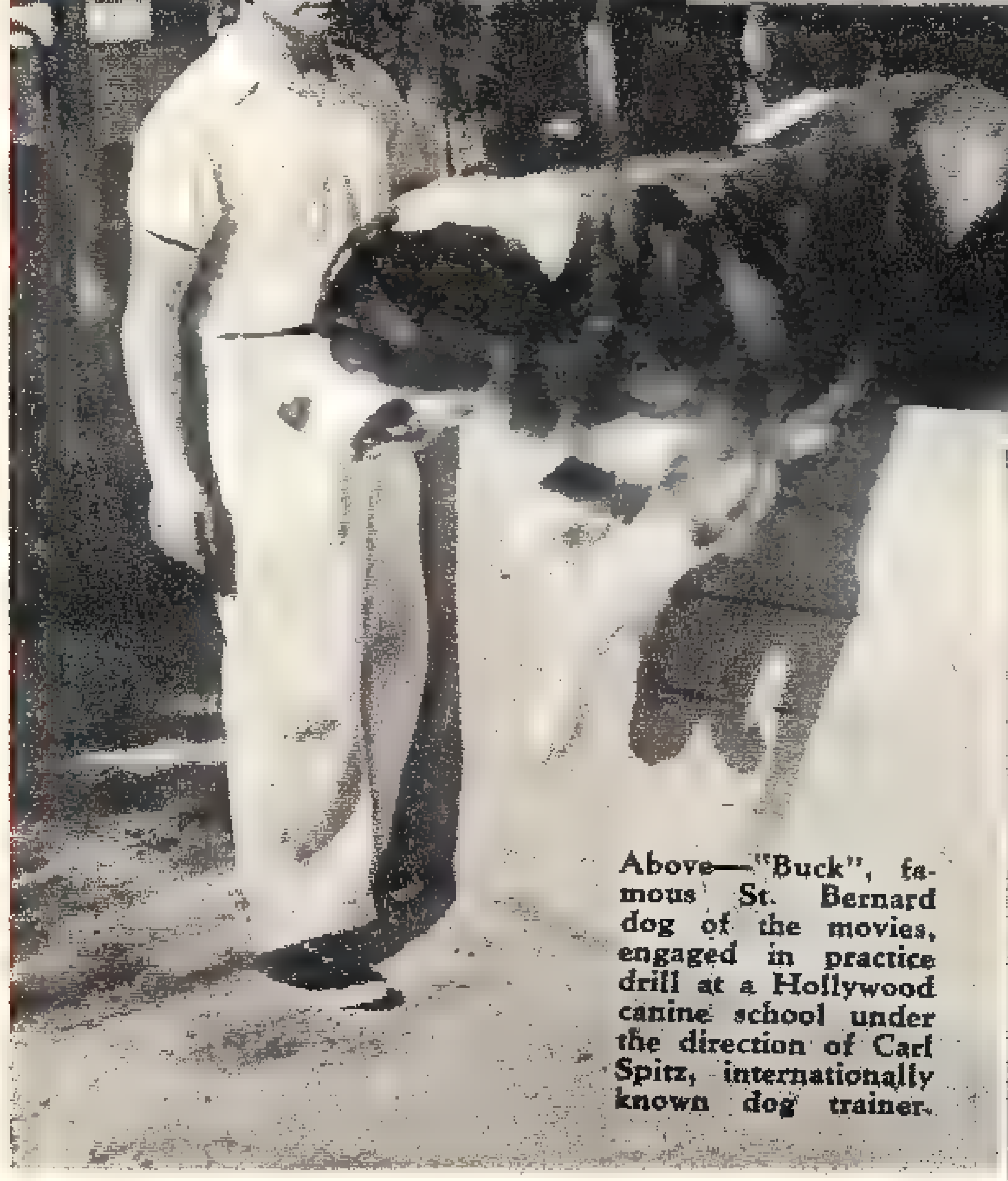


Breaking a dog to a leash is the starting point in the animal's education (sketch). Shown in the circle below is Jane Withers, popular juvenile movie star, with "Buck", famous canine screen actor.

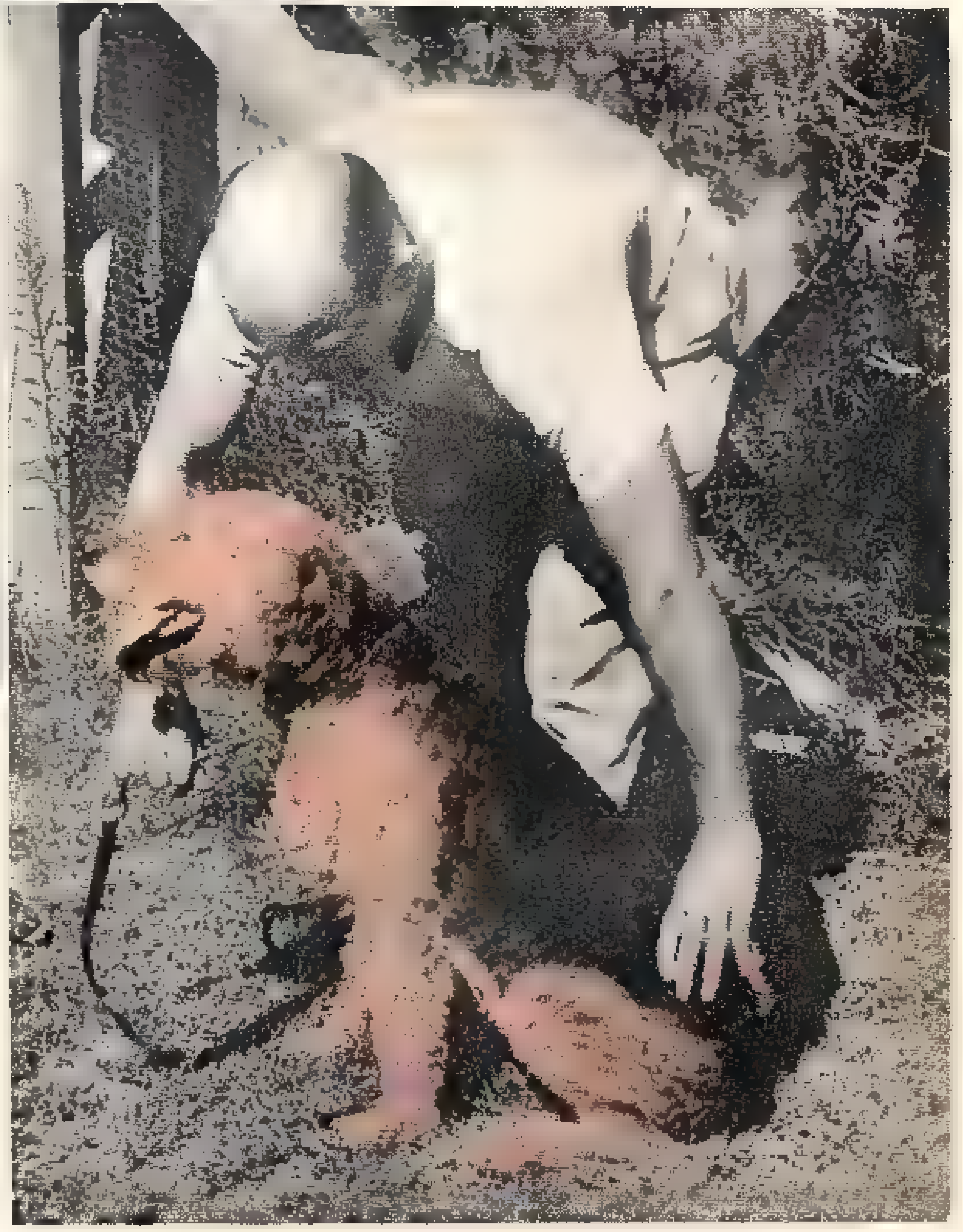


A high board fence can be used effectively when teaching a dog to "heel". By pressing inwardly with his leg, as shown above, the trainer blocks dog's passage, forcing him to retreat until it becomes habit to walk at his master's heels.





Above—"Buck", famous St. Bernard dog of the movies, engaged in practice drill at a Hollywood canine school under the direction of Carl Spitz, internationally known dog trainer.



A canine "pupil" can be taught to sit down on all fours by grasping his two front paws with right hand and stretching him out with the other, as shown above. Exerting a small downward pressure on a dog's hind quarters while holding leash, as shown below, teaches the animal to sit. The lessons must be repeated daily until the dog associates the actions with your orders.

YOUR dog may not be cut out for the movies but he can become an obedient, well-mannered pet if you adopt the training methods suggested by Hollywood's ace canine instructor.

His name is Carl Spitz and he has spent more than twenty years in preparing dogs for police and Red Cross work, "Seeing Eye" duty, the stage and motion pictures. The effectiveness of his methods may best be shown by the success his dogs have achieved in numerous motion pictures.

At the film studios, Spitz is an institution and whenever a script calls for a dog, one of his pupils generally gets the assignment. They have appeared in more than fifty-five motion pictures.

The stars of his troupe, Buck, a St. Bernard, and Prince, a Great Dane, move from one set to the next in the manner of busy human stars. They are products of the film training school operated by Spitz and his co-worker, Fritz Bache. It is one of the most complete layouts in America and the kennels are modern, to say the least. They are even equipped with radios to provide music, which, Spitz says, they enjoy. But one radio also serves a more practical purpose. It is connected up to a microphone at the trainer's bedside, and when a dog starts barking during the night he can be silenced by a blast on a whistle or a sharp rebuke from the reclined trainer.

Spitz believes a dog's education should parallel a human's and consequently his pupils are separated into three divisions—grammar, high school and college. A film contract usually awaits the college "graduate." Once in a blue moon a student completes his academic work with flying

FISHING for DISTANT EARTHQUAKES with a home-made seismograph

Designed for the amateur scientist, this easily-built instrument records earth tremors occurring in all parts of world.

by Don Murphy

EVERY few minutes, an earthquake vibrates through old Earth's rocky crust. On an average, more than 9,000 of these shocks occur every year—some of them sending buildings crashing to the ground and leaving ruined cities in their wake, others going unnoticed except by a few scientists who specialize in this subject.

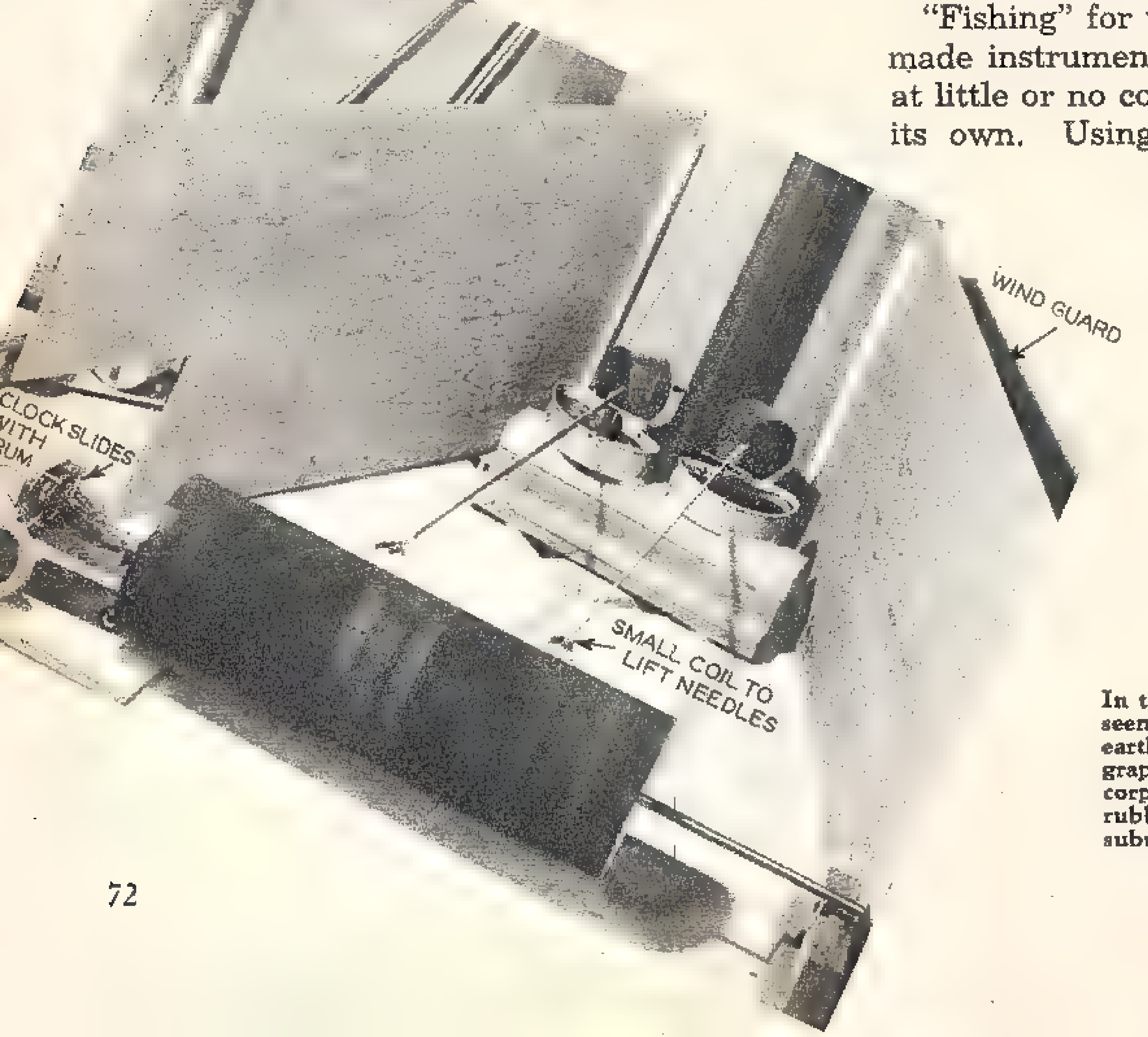
"Fishing" for these tremors with a home-made instrument, built from odds and ends at little or no cost, is a sport with thrills all its own. Using an instrument similar to that described below, Martin G. Murray, its designer, bagged complete records of the disastrous March, 1933, earthquake that devastated a whole section of southern California. So good were his 'grams that seismologists of nationally known observatories were glad to exchange records with him from their big, complicated machines costing hundreds of dollars.

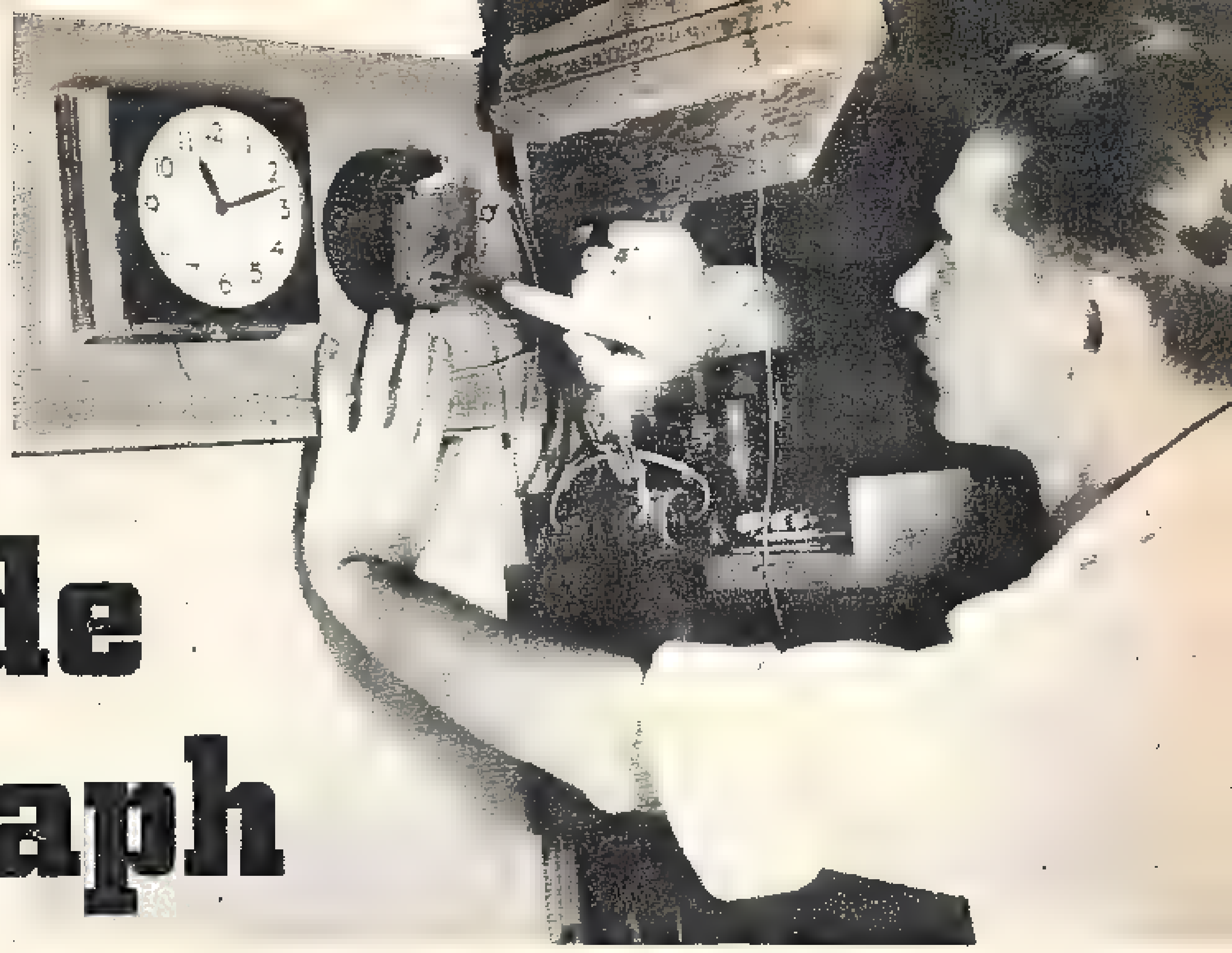
A seismograph is nothing but a large pendulum with a pointer which scratches a fine line on a revolving drum. Strangely, when a quake comes, it moves the drum itself —*not* the pendulum, which swings freely and whose inertia keeps it at rest, while the ground and everything attached rigidly to it quivers and shakes. The vibration of the earth is greatly magnified by a long arm attached to the pendulum bob, so that the record may be more easily studied. Simply by changing the length of the pendulum, the machine may be "tuned" to far-away quakes much as a piano is set to a tuning fork.

To build a simple, yet effective, seismograph, first cut a triangular piece of scrap plate ⅜ or ½-inch thick and 18 to 20 inches on the side, as shown in Fig. 1. Your local blacksmith will help you out on this for a small charge. Drill a ½-inch hole through the plate near each corner and weld a 42-inch piece of 2-inch angle iron, vertically, in the center of it.

Near the top of the angle iron, drill a ¼-inch hole through each face and fasten a ¼ by 1½-inch bolt.

In the picture above, Martin G. Murray is seen examing a seismogram made on his earthquake recorder. A close-up of seismograph appears at left. Note that it incorporates such special refinements as a rubber tired drum carriage and vanes submerged in oil to dampen vibrations.


WIND GUARD
CLOCK SLIDES WITH DRUM
SMALL COIL TO LIFT NEEDLES



Electric magnets attached to the recording arms of the seismograph are automatically raised each hour to provide a time check on the record itself. A sweep second electric clock, with face removed, is provided with electric contacts that close magnetic circuit.

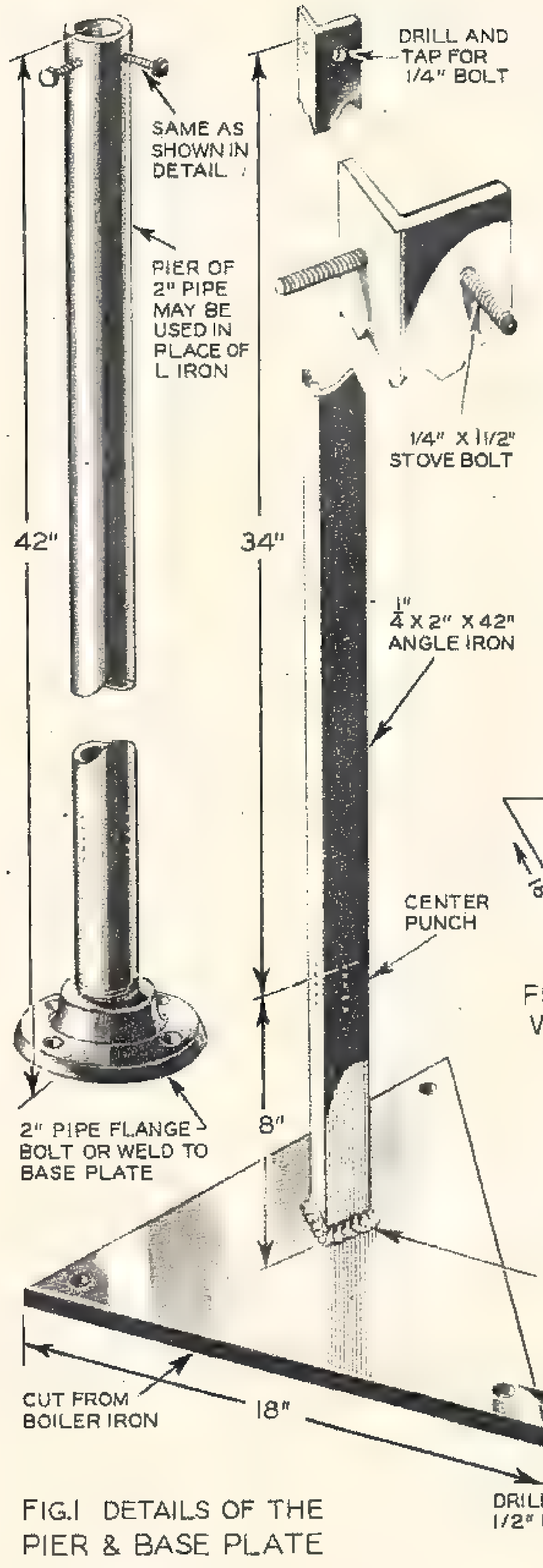

DRILL AND TAP FOR 1/4" BOLT
SAME AS SHOWN IN DETAIL
PIER OF 2" PIPE MAY BE USED IN PLACE OF L IRON
1/4" X 1 1/2" STOVE BOLT
42"
34"
1/4" X 2" X 42" ANGLE IRON
CENTER PUNCH
8"
2" PIPE FLANGE BOLT OR WELD TO BASE PLATE
WELD
CUT FROM BOILER IRON
18"
DRILL FOR 1/2" BOLT

FIG.1 DETAILS OF THE PIER & BASE PLATE

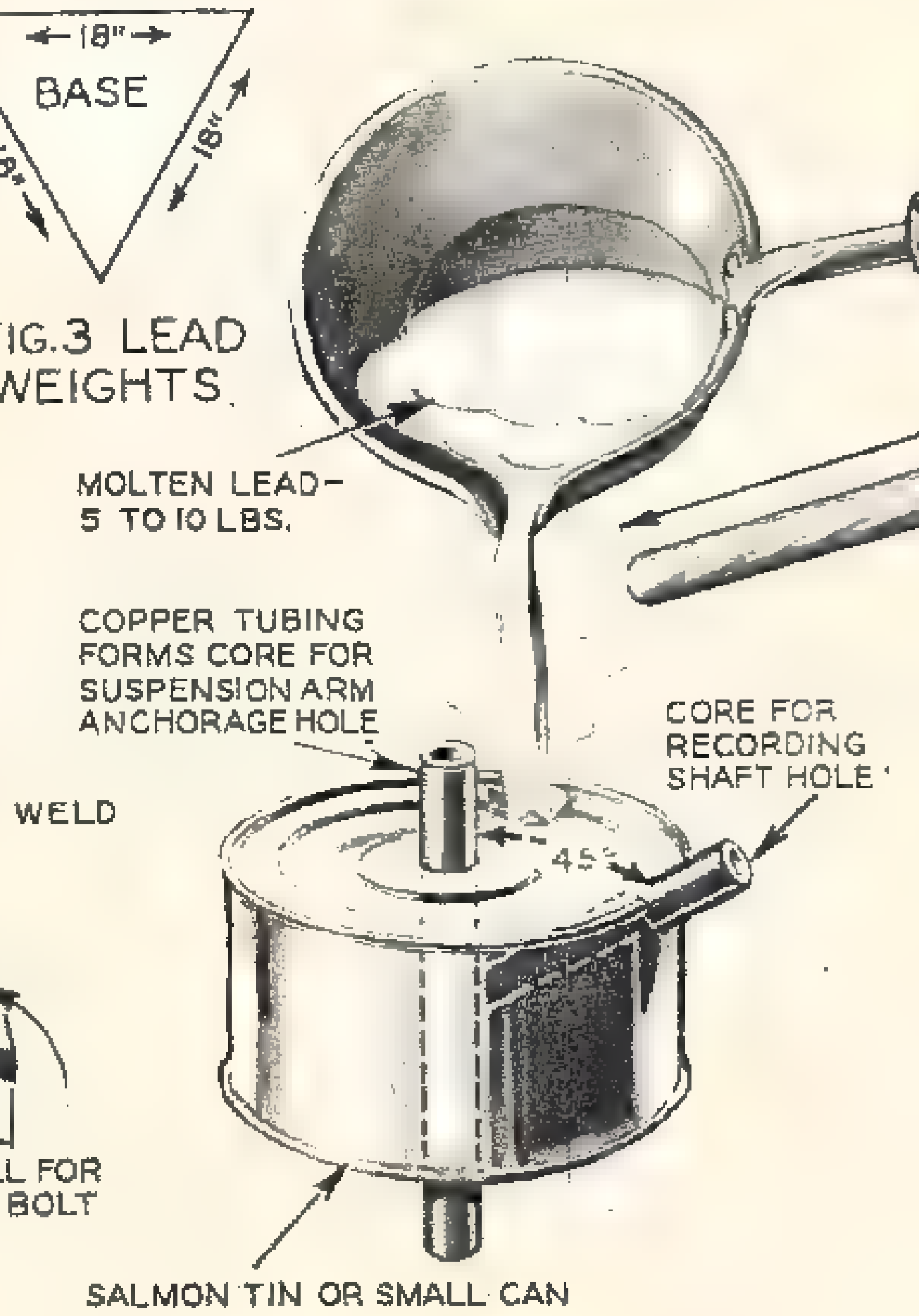

BASE
18"
18"
18"
MOLTEN LEAD- 5 TO 10 LBS.
COPPER TUBING FORMS CORE FOR SUSPENSION ARM ANCHORAGE HOLE
CORE FOR RECORDING SHAFT HOLE
45°
SALMON TIN OR SMALL CAN

FIG.3 LEAD WEIGHTS

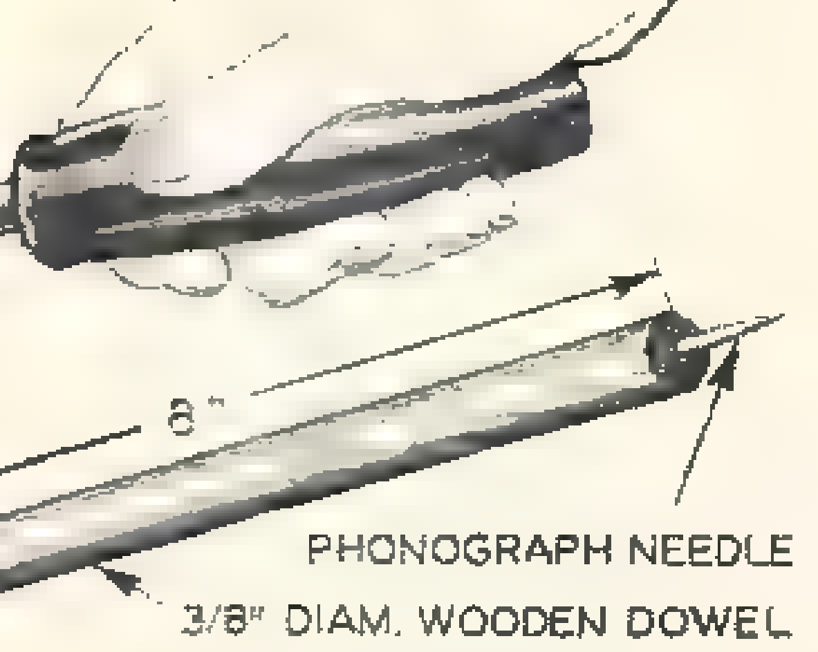
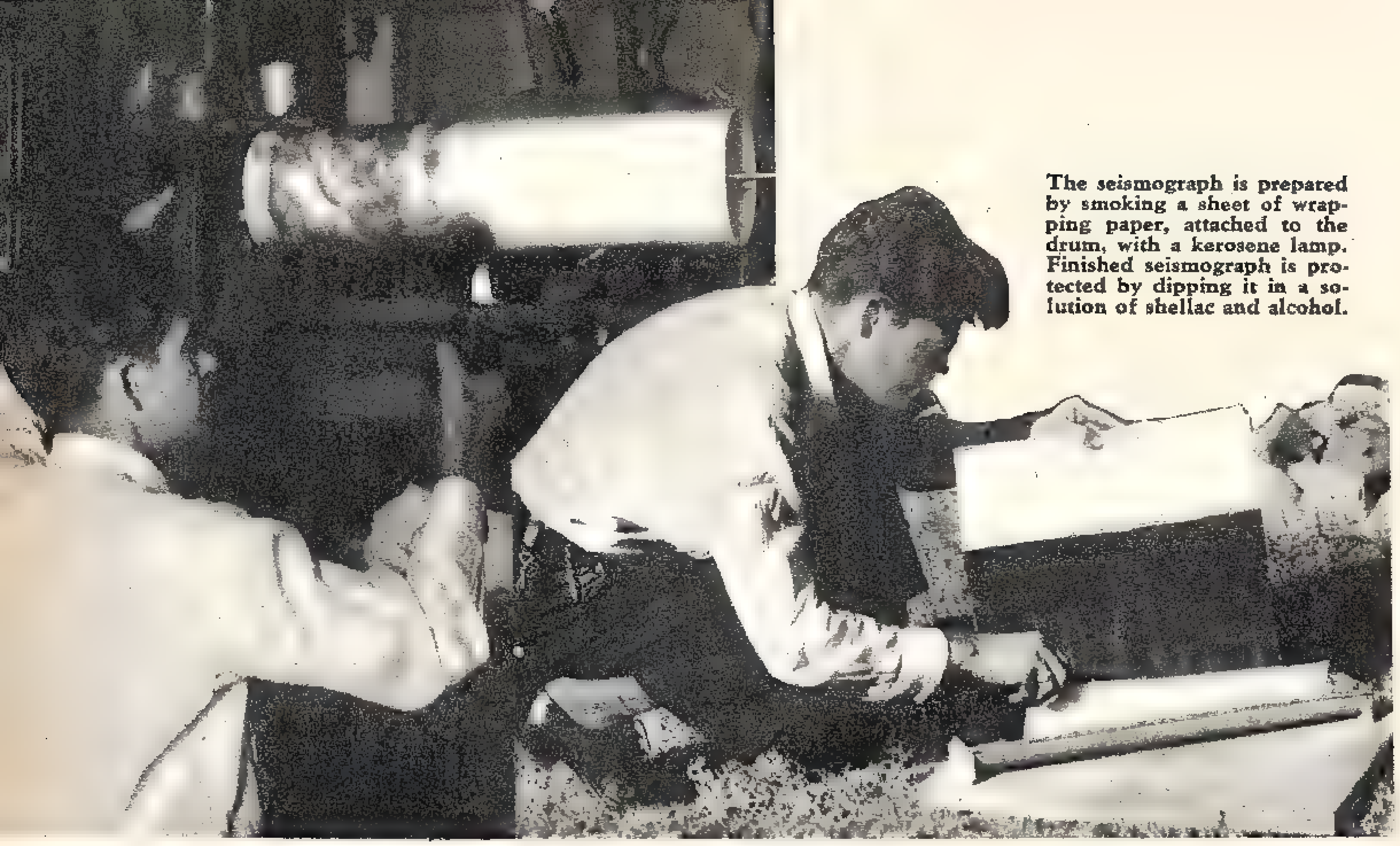

8"
PHONOGRAPH NEEDLE
3/8" DIAM. WOODEN DOWEL

FIG. 2 - SUSPENSION ARMS - 2 REQUIRED

Details at left show the pier suggested by the designer as well as a simpler pipe column which may be substituted. Fig. 3 shows the method used in casting lead pendulum weights. Small tin cans serve as molds for molten metal.



The seismograph is prepared by smoking a sheet of wrapping paper, attached to the drum, with a kerosene lamp. Finished seismograph is protected by dipping it in a solution of shellac and alcohol.

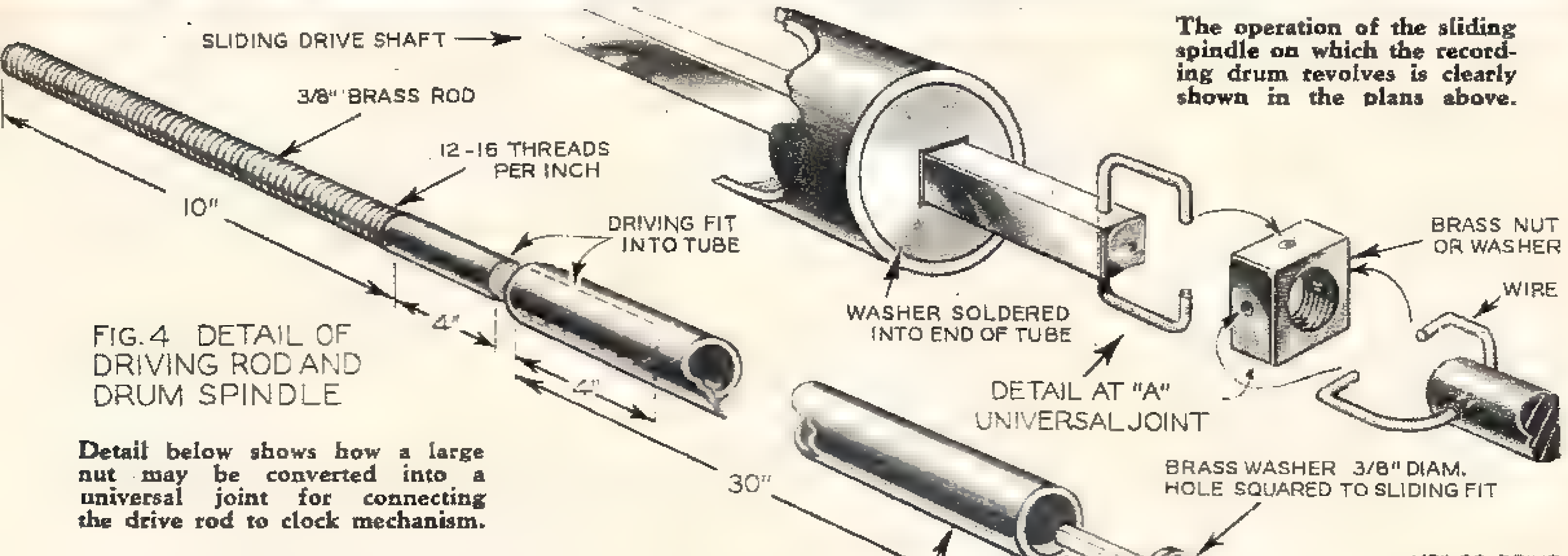

SLIDING DRIVE SHAFT
3/8" BRASS ROD
12-16 THREADS PER INCH
10"
DRIVING FIT INTO TUBE
4"
4"
30"
WASHER SOLDERED INTO END OF TUBE
DETAIL AT "A" UNIVERSAL JOINT
BRASS NUT OR WASHER
WIRE
BRASS WASHER 3/8" DIAM. HOLE SQUARED TO SLIDING FIT

FIG. 4 DETAIL OF DRIVING ROD AND DRUM SPINDLE

The operation of the sliding spindle on which the recording drum revolves is clearly shown in the plans above.

Detail below shows how a large nut may be converted into a universal joint for connecting the drive rod to clock mechanism.

Approximately 7 inches above the base, make three or four center punch marks, one above another, on each face of the angle iron.

This frame comprises the pier or support for the magnifying arms. It is now ready to be bolted to some firm, stationary foundation such as the garage floor. Care should be taken in placing the base (see Fig. 6), so that the faces of the angle iron will be in a true east-west, north-south position, so that you may determine the direction of a disturbance registered by the instrument. By using double nuts on the foundation, you are able to level the base and so keep the recording arms, to be mounted later, parallel to each other.

These magnifying arms should be made of some light metal beam, thirty inches long. Strips from an old Venetian blind or other light wood may be used instead, provided cross members and wire braces are attached to stiffen them.

Fashion two wooden shafts, as indicated in Fig. 2, about ⅜-inch in diameter and from 4 to 8 inches in length. Into one end of each, insert an old phonograph needle, pointed end out. The other end of each shaft is later fitted with the lead weights.

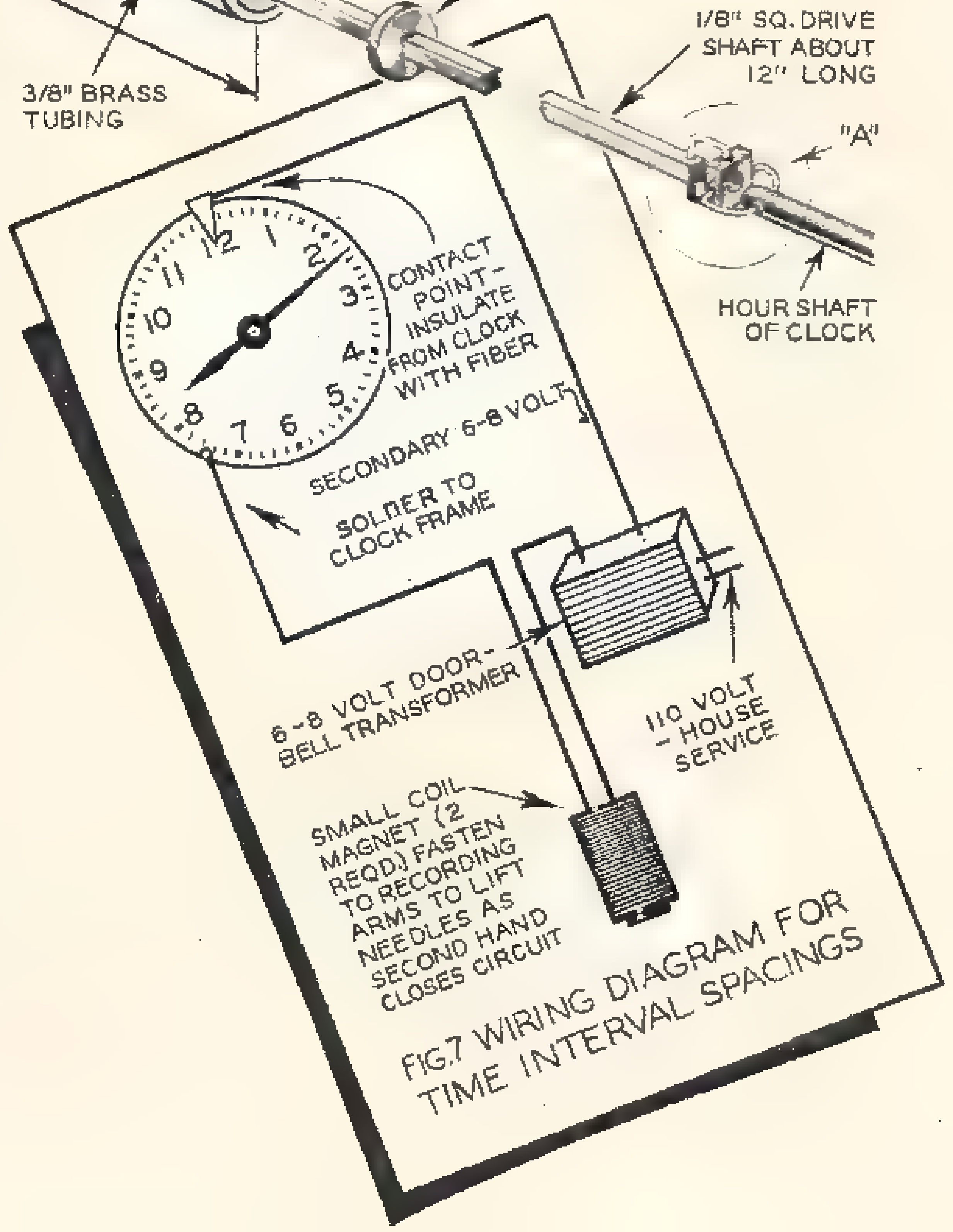
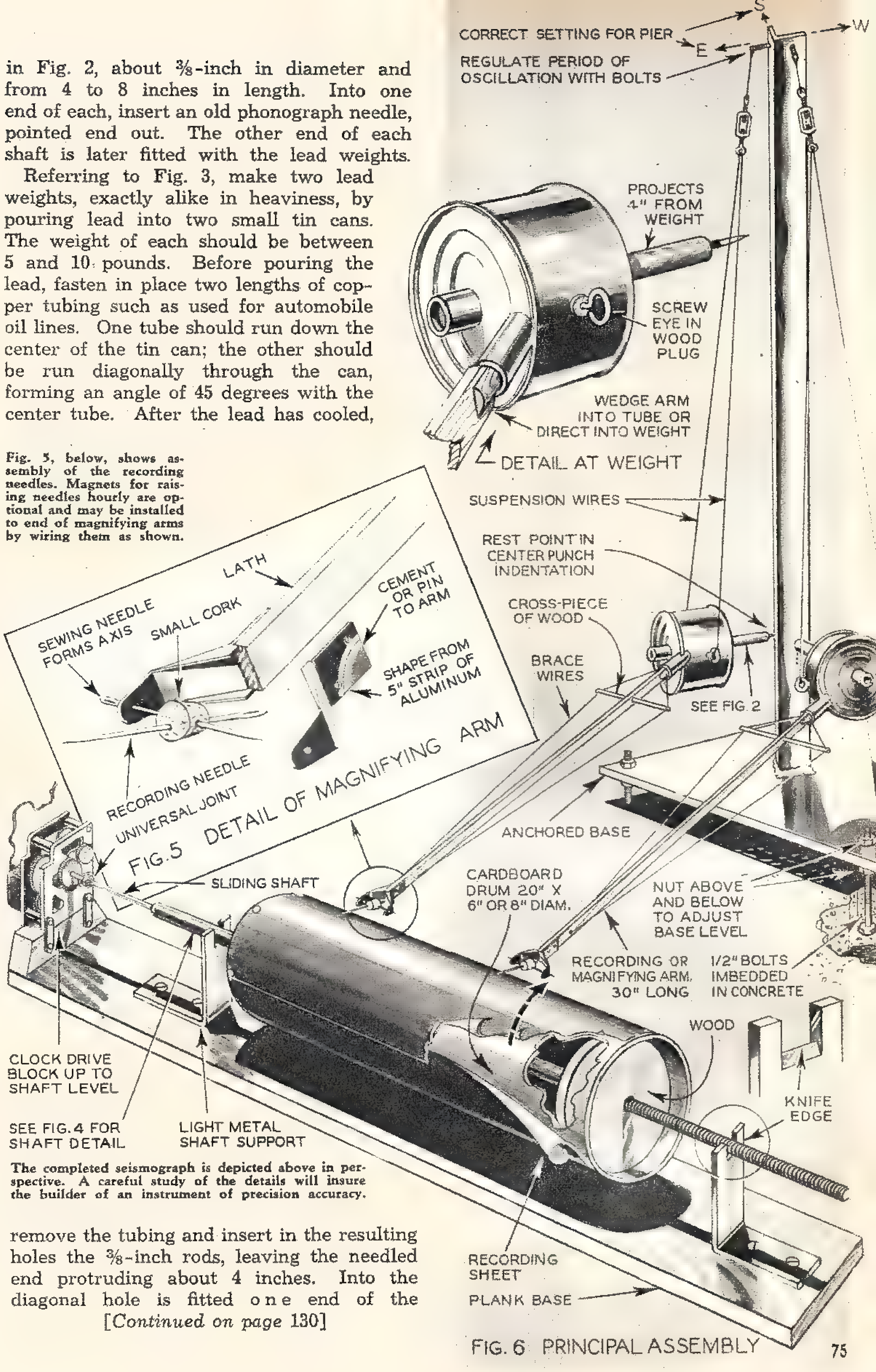

3/8" BRASS TUBING
1/8" SQ. DRIVE SHAFT ABOUT 12" LONG
"A"
HOUR SHAFT OF CLOCK
12
1
2
3
4
5
6
7
8
9
10
11
CONTACT POINT - INSULATE FROM CLOCK WITH FIBER
SECONDARY 6-8 VOLT
SOLDER TO CLOCK FRAME
6-8 VOLT DOOR-BELL TRANSFORMER
110 VOLT - HOUSE SERVICE
SMALL COIL MAGNET (2 REQD.) FASTEN TO RECORDING ARMS TO LIFT NEEDLES AS SECOND HAND CLOSES CIRCUIT

FIG. 7 WIRING DIAGRAM FOR TIME INTERVAL SPACINGS

Referring to Fig. 3, make two lead weights, exactly alike in heaviness, by pouring lead into two small tin cans. The weight of each should be between 5 and 10 pounds. Before pouring the lead, fasten in place two lengths of copper tubing such as used for automobile oil lines. One tube should run down the center of the tin can; the other should be run diagonally through the can, forming an angle of 45 degrees with the center tube. After the lead has cooled, remove the tubing and insert in the resulting holes the ⅜-inch rods, leaving the needled end protruding about 4 inches. Into the diagonal hole is fitted one end of the

[*Continued on page 130*]

Fig. 5, below, shows assembly of the recording needles. Magnets for raising needles hourly are optional and may be installed to end of magnifying arms by wiring them as shown.


CORRECT SETTING FOR PIER
S
E
W
REGULATE PERIOD OF OSCILLATION WITH BOLTS
PROJECTS 4" FROM WEIGHT
SCREW EYE IN WOOD PLUG
WEDGE ARM INTO TUBE OR DIRECT INTO WEIGHT
DETAIL AT WEIGHT
SUSPENSION WIRES
REST POINT IN CENTER PUNCH INDENTATION
CROSS-PIECE OF WOOD
BRACE WIRES
SEE FIG. 2
ANCHORED BASE
LATH
SEWING NEEDLE FORMS AXIS
SMALL CORK
CEMENT OR PIN TO ARM
SHAPE FROM 5" STRIP OF ALUMINUM
RECORDING NEEDLE
UNIVERSAL JOINT
FIG.5 DETAIL OF MAGNIFYING ARM
SLIDING SHAFT
CARDBOARD DRUM 20" X 6" OR 8" DIAM.
NUT ABOVE AND BELOW TO ADJUST BASE LEVEL
RECORDING OR MAGNIFYING ARM, 30" LONG
1/2" BOLTS IMBEDDED IN CONCRETE
WOOD
KNIFE EDGE
CLOCK DRIVE BLOCK UP TO SHAFT LEVEL
SEE FIG. 4 FOR SHAFT DETAIL
LIGHT METAL SHAFT SUPPORT
RECORDING SHEET
PLANK BASE

The completed seismograph is depicted above in perspective. A careful study of the details will insure the builder of an instrument of precision accuracy.

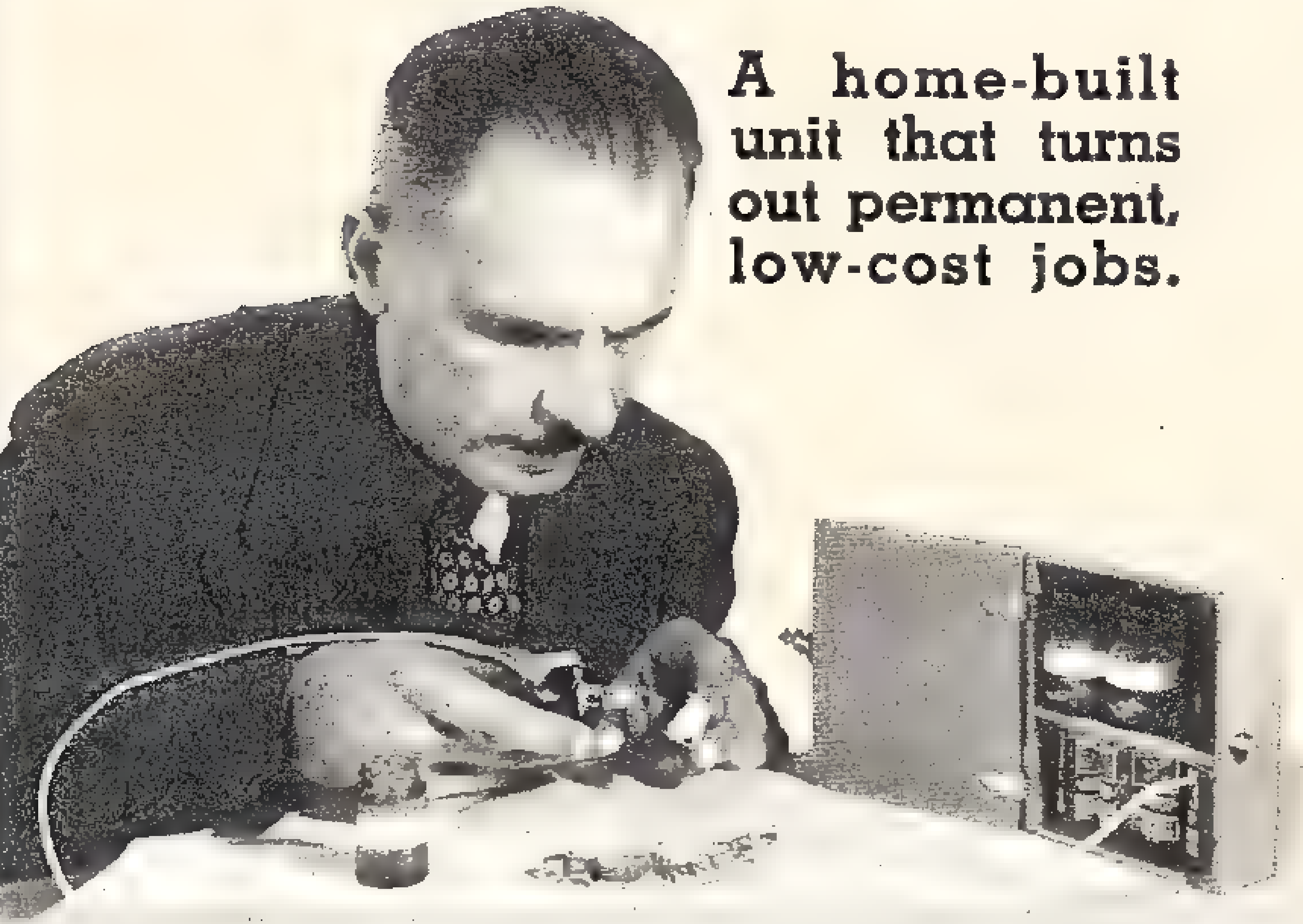
FIG. 6 PRINCIPAL ASSEMBLY

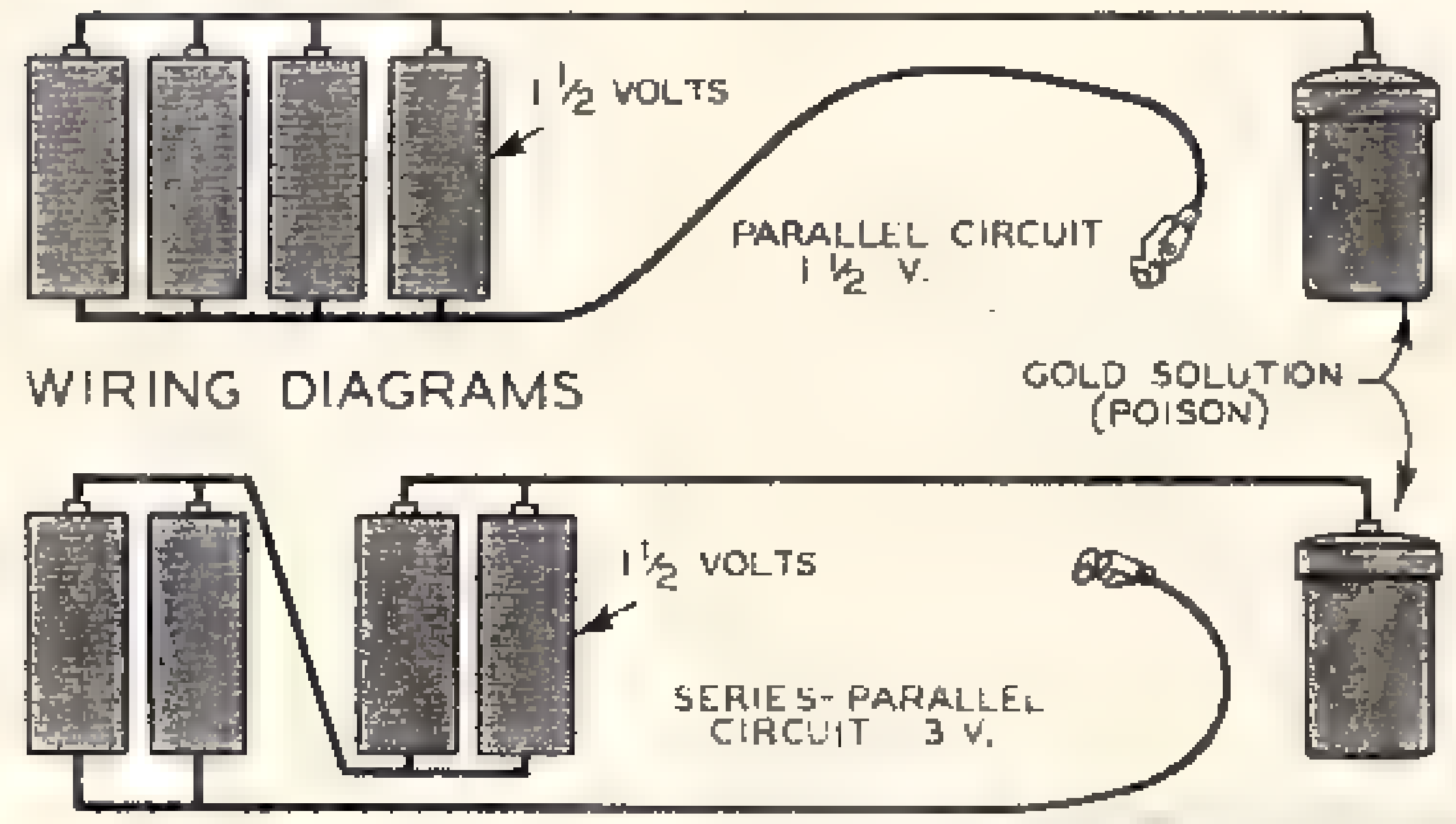
Pocket Electro Plating Outfit

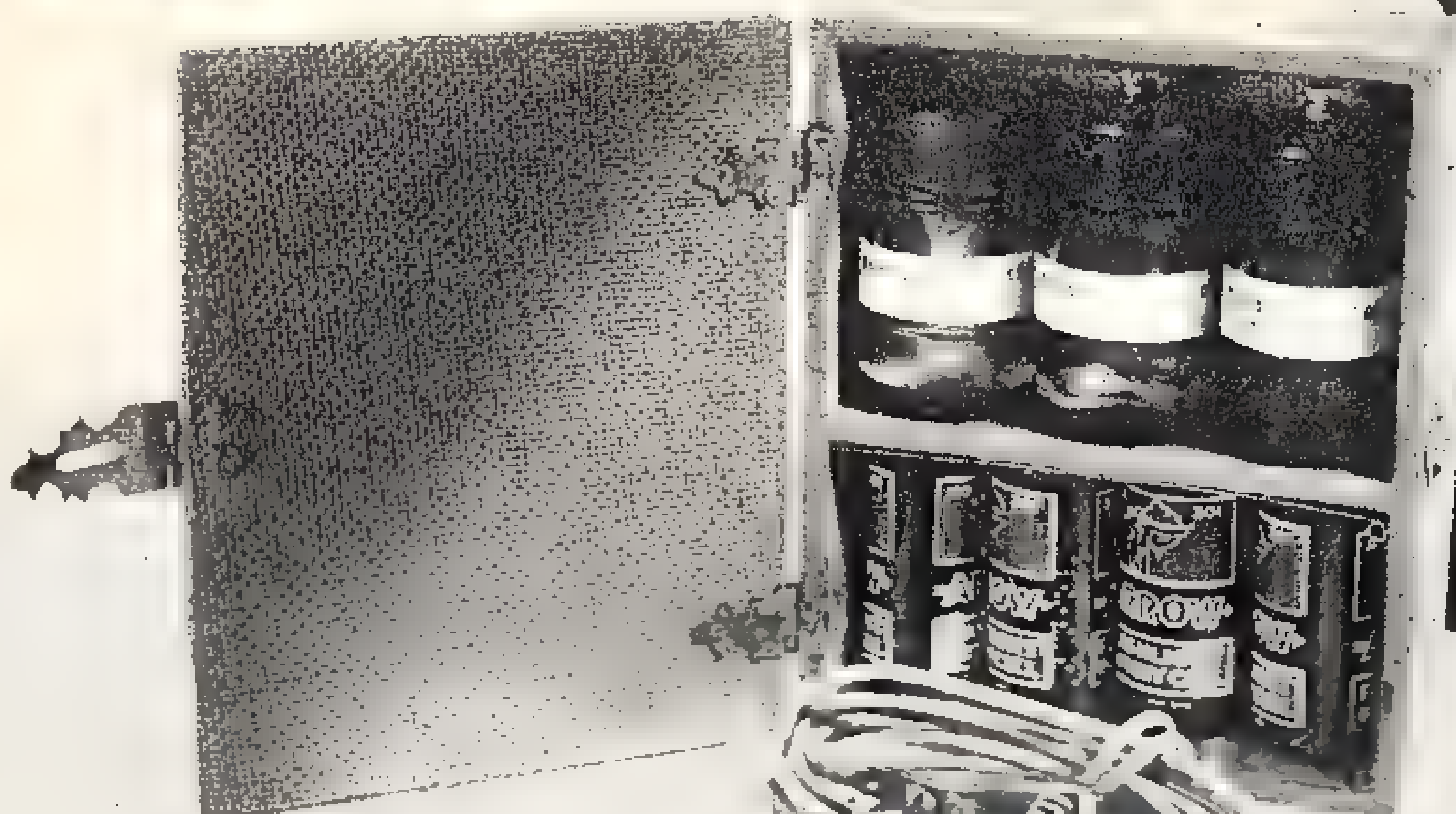
by Kenneth Murray

A home-built unit that turns out permanent, low-cost jobs.

The ends of the glass tubes used in making electrodes are flared over a bunsen burner flame (below).


Plating articles of jewelry with the compact electroplating outfit, shown above, is an easy and simple process, but the objects must be clean and free of grease, otherwise the job will appear streaked.


1½ VOLTS
PARALLEL CIRCUIT 1½ V.
WIRING DIAGRAMS
GOLD SOLUTION (POISON)
1½ VOLTS
SERIES-PARALLEL CIRCUIT 3 V.



The compact carrying case (above) holds everything you need for electroplating with gold or silver. On opening the lid of the case (left), the plating solutions and current source are readily available. Left, above—Wiring diagram showing how change of circuit can be made to increase voltage delivered by the batteries.

HERE is a complete electroplating outfit—batteries, chemical solutions, applicators and polish—which is contained in a case no larger than your hand, and small enough to easily fit in your pocket. An even smaller outfit, for the vest pocket, can be made by using tiny "penlite" size batteries, and by substituting glass vials for the 1-ounce plating solution bottles chosen for this model.

Despite its miniature size, this is a thoroughly practical outfit and with it you can electroplate a thin or a heavy deposit of gold or silver on any small article. It is particularly suited to the plating or refinishing of small pieces of jewelry, on which it does first-class work in a remarkably short time. As for larger work, it will handle the replating of silverware, and you can gold plate the handles of knives and forks and similar articles if you wish. Automobile head-lamp reflectors can be resilvered when the finish becomes dull, and other automotive parts can be gilded, if you wish, at a cost of only a few cents. The work done by the outfit is as durable and permanent as that done by professional, large-scale plating methods.

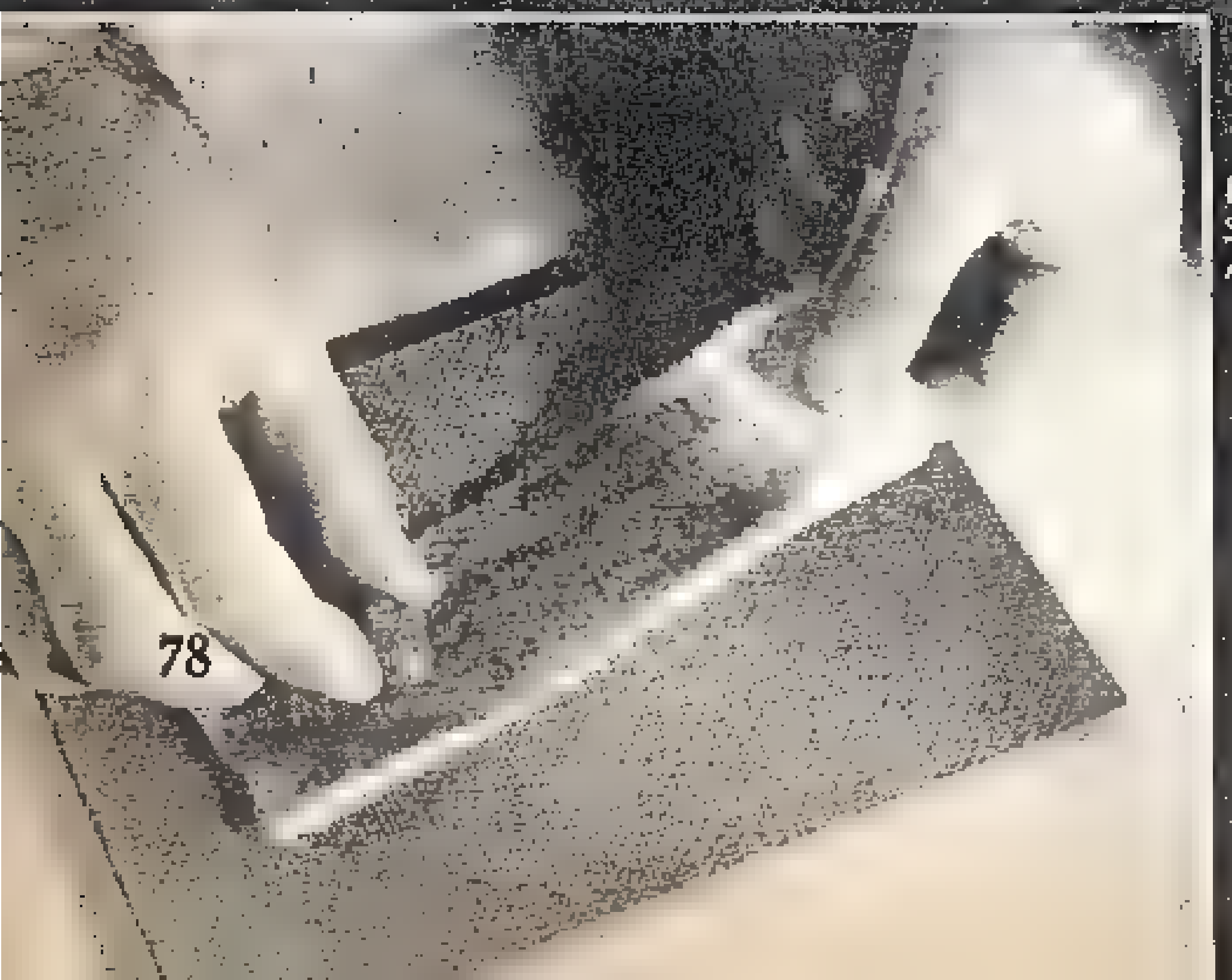
First construct the case, using pressed wood and following the dimensions shown in the accompanying drawings. Although for purposes of illustration the case is made of pressed wood in the natural finish, you can also build it in ebony black, which presents a very fine appearance. Small brads, cut ⅜-inch long, are used for riveting the hardware hinges and lock in place. Four brass upholstery tacks may be attached to the bottom to serve as rests, if desired.

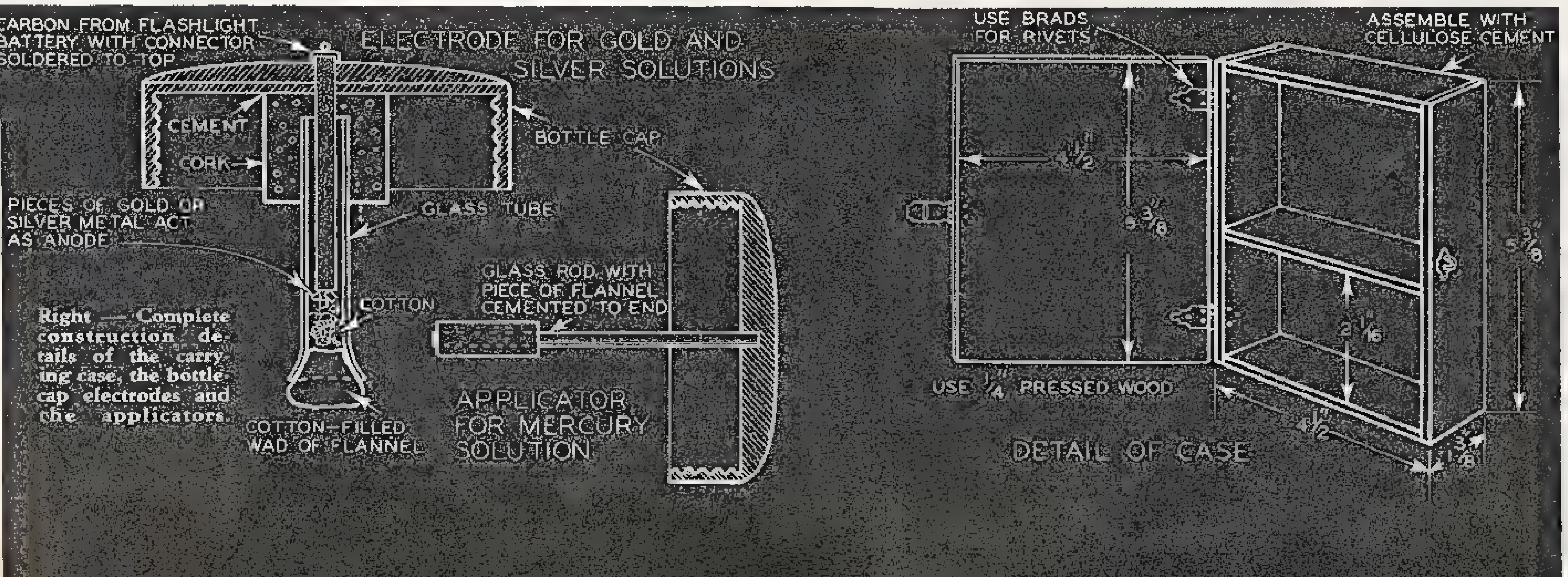
You will notice that the battery space, or lower compartment, is just large enough for small flashlight cells. The method of making contact is shown in a photograph on page 80; two strips of thin spring brass, each 1½ by 4 inches, are given a slightly convex bend so as to make good contact with the positive and negative poles of the batteries. Small tabs left on the ends are rolled around a piece of wire to receive the tinned leads which connect with the electrode and the spring clip with which the work is held.

This circuit will deliver about 1½ volts to the electrode, which is usually sufficient. According to the amount of resistance in the electrode, as will be mentioned later, it may be desirable to use a series-parallel circuit, delivering about 3 volts, in order to speed up the deposition of plating metal. The method of wiring the batteries for a series-parallel circuit is shown in one of the accompanying drawings.

In order to make the combined electrodes and plating solution container units, get three 1-ounce wide-mouth glass bottles from your

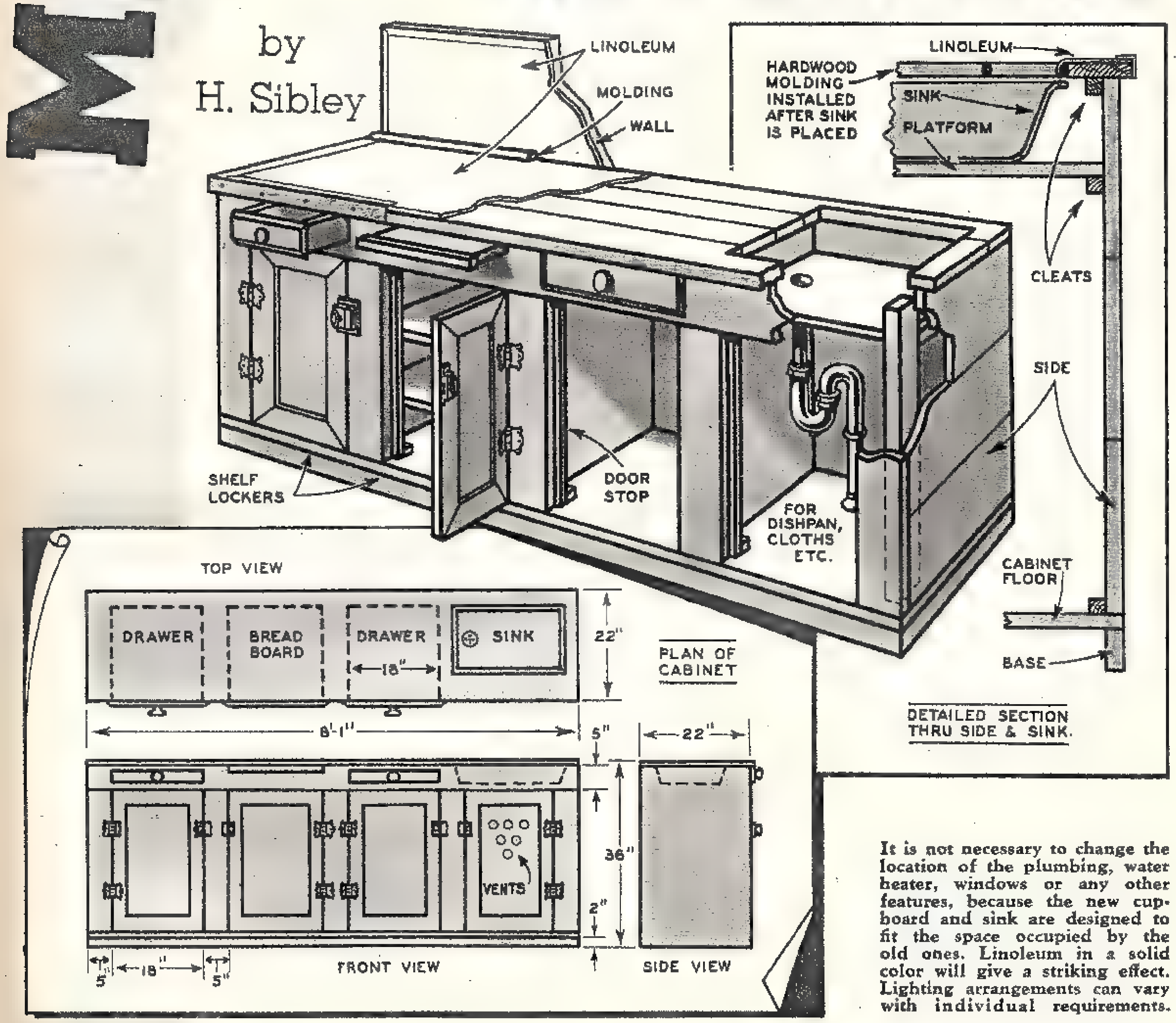
A polishing cloth, for burnishing the plated silver or gold, is made by rubbing a strip of flannel with jewelers' rouge (below).



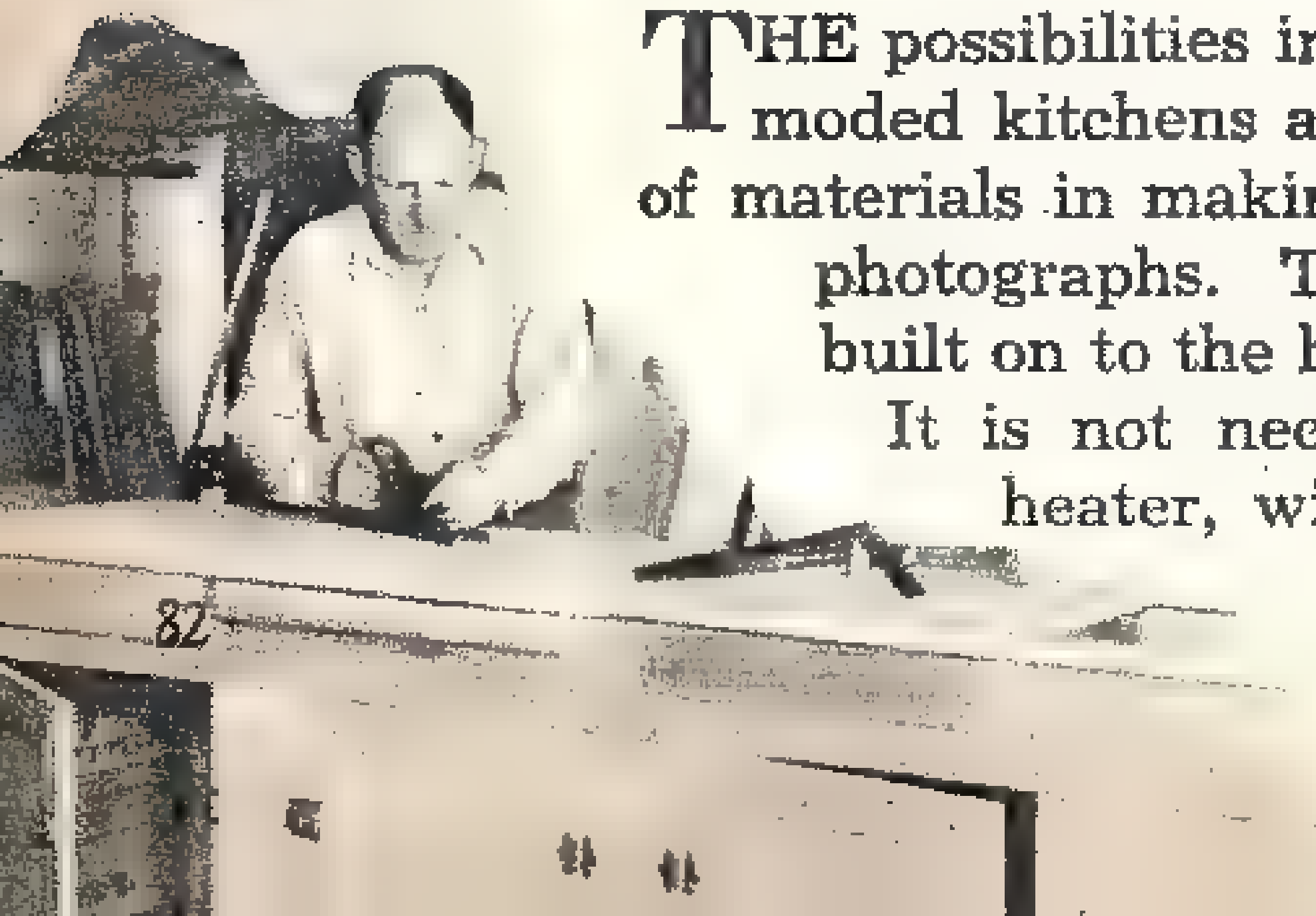

CARBON FROM FLASHLIGHT BATTERY WITH CONNECTOR SOLDERED TO TOP
ELECTRODE FOR GOLD AND SILVER SOLUTIONS
CEMENT
CORK
BOTTLE CAP
PIECES OF GOLD OR SILVER METAL ACT AS ANODE
GLASS TUBE
COTTON
GLASS ROD WITH PIECE OF FLANNEL CEMENTED TO END
COTTON-FILLED WAD OF FLANNEL
APPLICATOR FOR MERCURY SOLUTION
USE BRADS FOR RIVETS
ASSEMBLE WITH CELLULOSE CEMENT
4½"
5⅜"
5⅝"
2 1/16"
USE ¼" PRESSED WOOD
4½"
1⅜"
DETAIL OF CASE
Right — Complete construction details of the carrying case, the bottle-cap electrodes and the applicators.

MODERNIZING OUTMODED FARM KITCHENS

by
H. Sibley


LINOLEUM
MOLDING
WALL
SHELF LOCKERS
DOOR STOP
FOR DISHPAN, CLOTHS ETC.
HARDWOOD MOLDING INSTALLED AFTER SINK IS PLACED
LINOLEUM
SINK
PLATFORM
CLEATS
SIDE
CABINET FLOOR
BASE
DETAILED SECTION THRU SIDE & SINK.
TOP VIEW
DRAWER
BREAD BOARD
DRAWER
18"
SINK
22"
PLAN OF CABINET
8'-1"
5"
22"
36"
2"
VENTS
5"
18"
5"
FRONT VIEW
SIDE VIEW

It is not necessary to change the location of the plumbing, water heater, windows or any other features, because the new cupboard and sink are designed to fit the space occupied by the old ones. Linoleum in a solid color will give a striking effect. Lighting arrangements can vary with individual requirements.



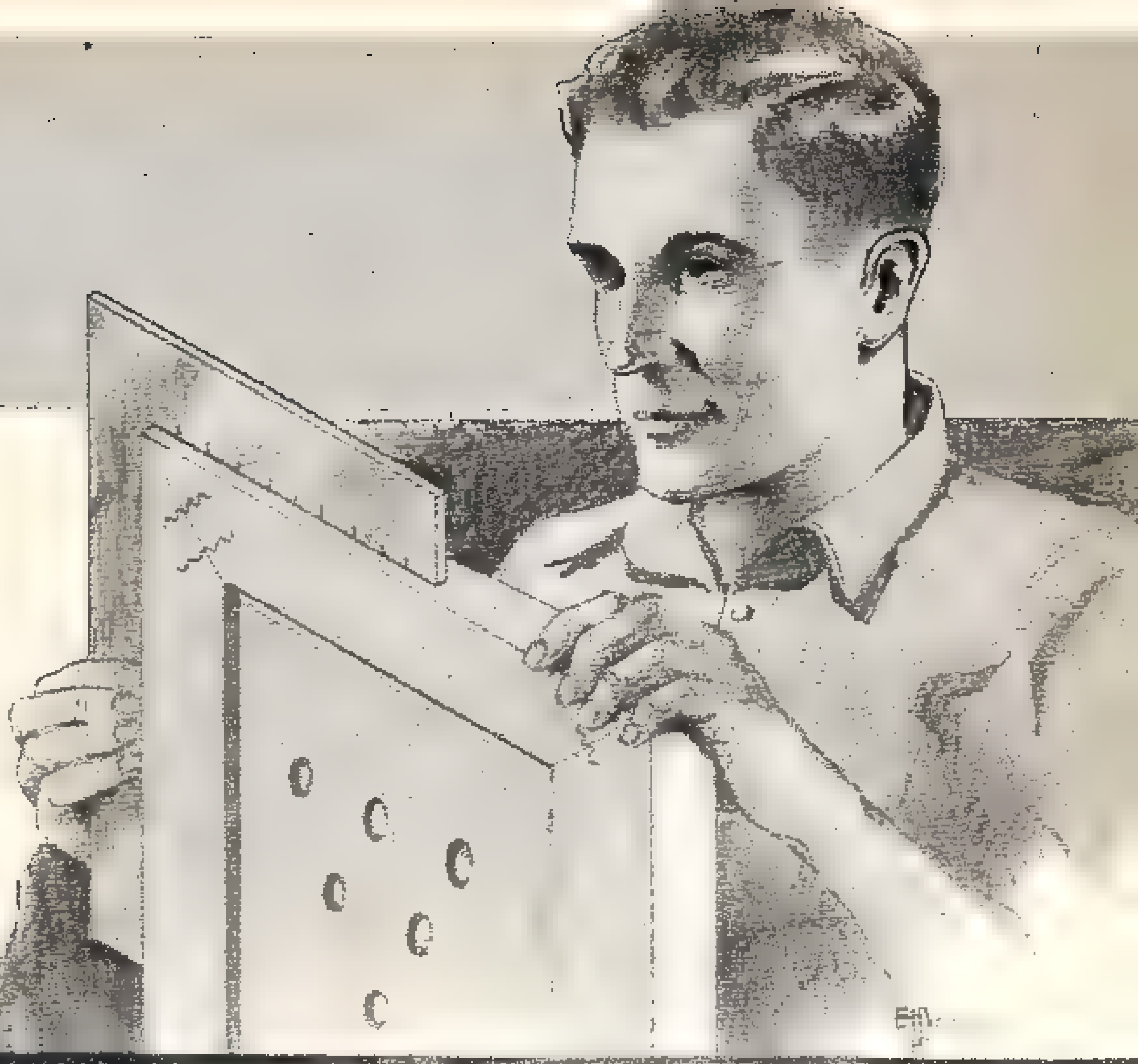
THE possibilities in improving the appearance and convenience of old, outmoded kitchens are so great that one will not begrudge the time and cost of materials in making the change. A typical example is illustrated in these photographs. This case is interesting because originally it was a lean-to built on to the house in the manner of an enclosed porch.

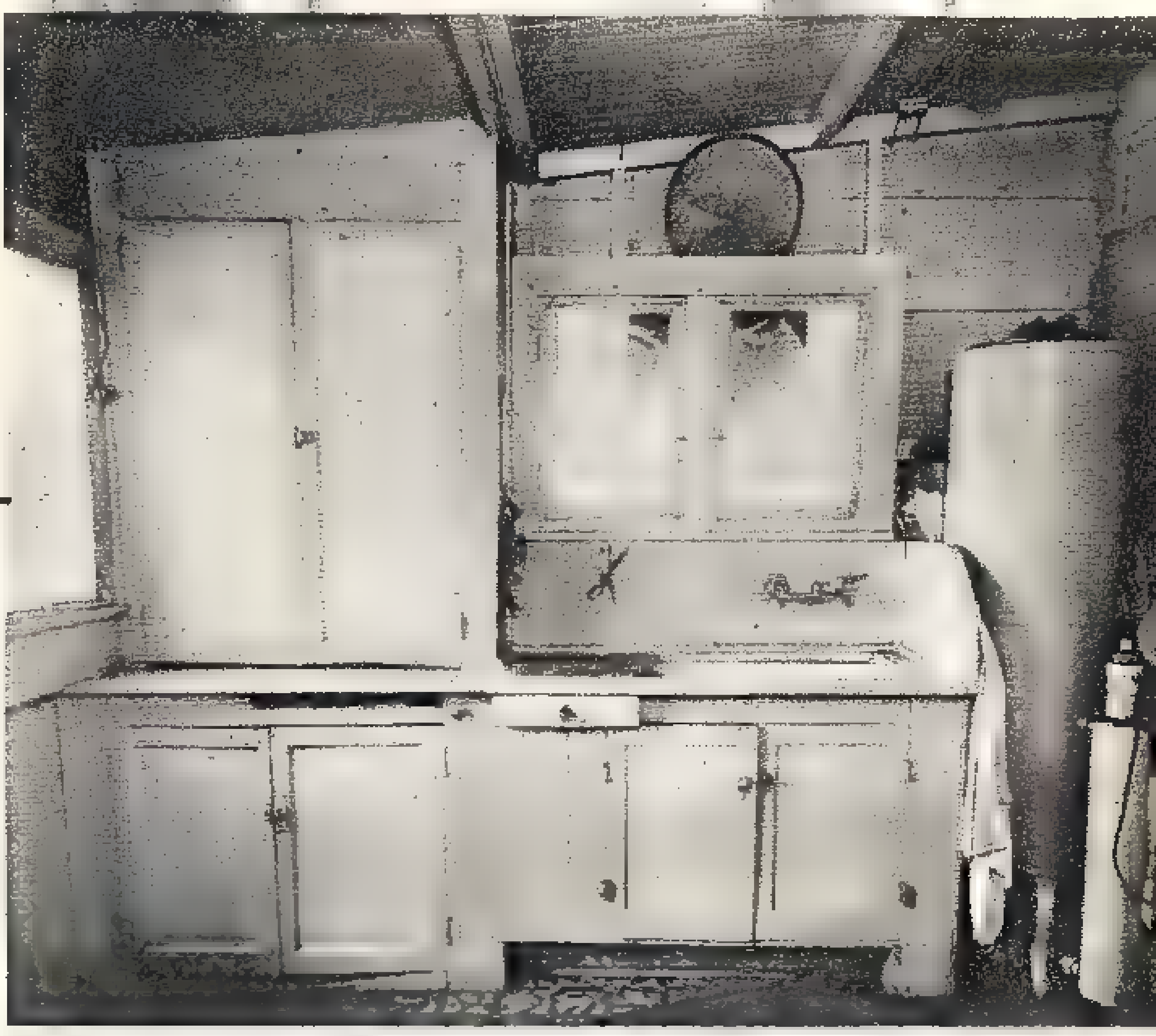
It is not necessary to change the location of the plumbing, water heater, windows or any other feature because the new cupboard and sink were designed to fit into the space occupied by the old ones.

Dimensions given in the drawing are general and can be adapted to the individual case. Construction throughout is of pine and since it is to be painted, the most expensive grade is not required. Construction of the cabinet follows standard practice, with the usual drawers, rails, cleats, door stops, sink compartment, etc. In this job the sink bottom rests on boards instead of being suspended by the rim, permitting installation after the cabinet top is put on permanently.

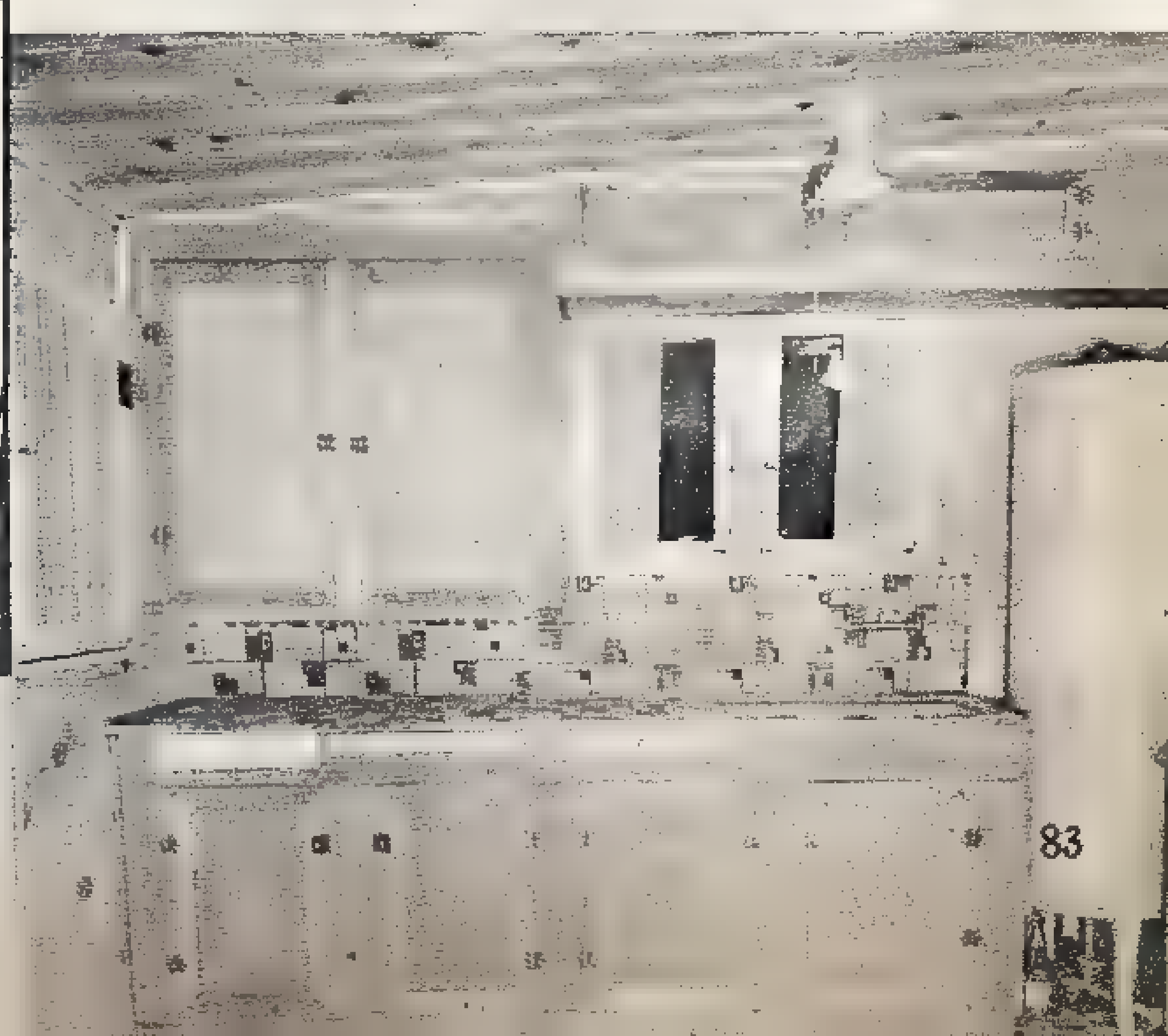
Cabinet doors are simply four mitred and rabbeted frame-members assembled upon a plywood panel, and secured with casein glue and corrugated fasteners. Drawers and bread-board are provided, the former fitted with drawer pulls, the latter having a strip across the front.

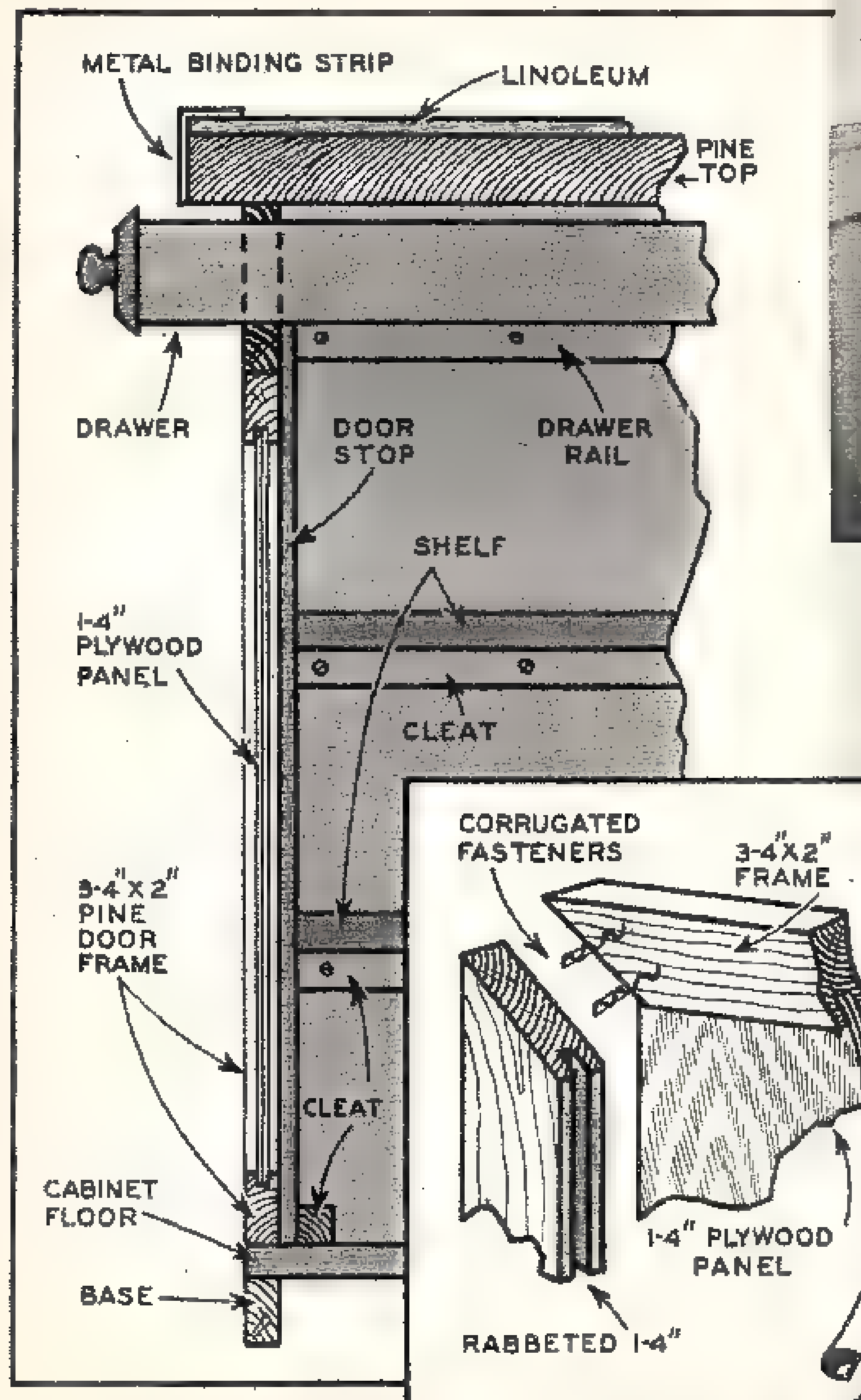
The top is covered with tile-pattern linoleum bound with aluminum or, if you care to go to the extra expense, chromium-plated angle-strip.





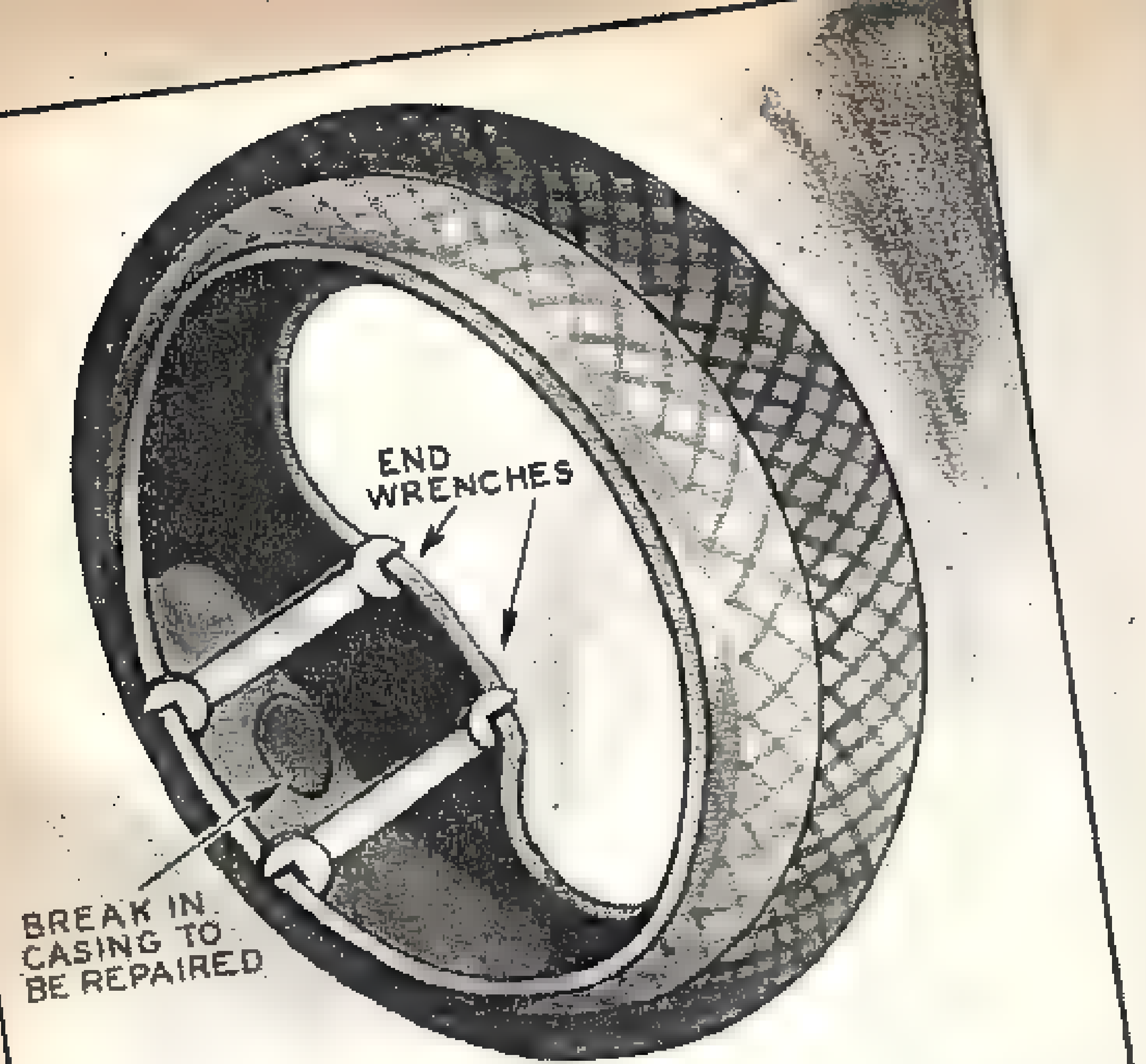
Above—A typical example of outmoded kitchen cabinet and sink in many farm homes. Below is shown the same kitchen after a little work and small amount of material have changed the old style into a kitchen as modern as those in many new homes. While actual placement of original features has not changed, the kitchen as a whole has taken on an entirely new appearance and gives added convenience to the housewife.



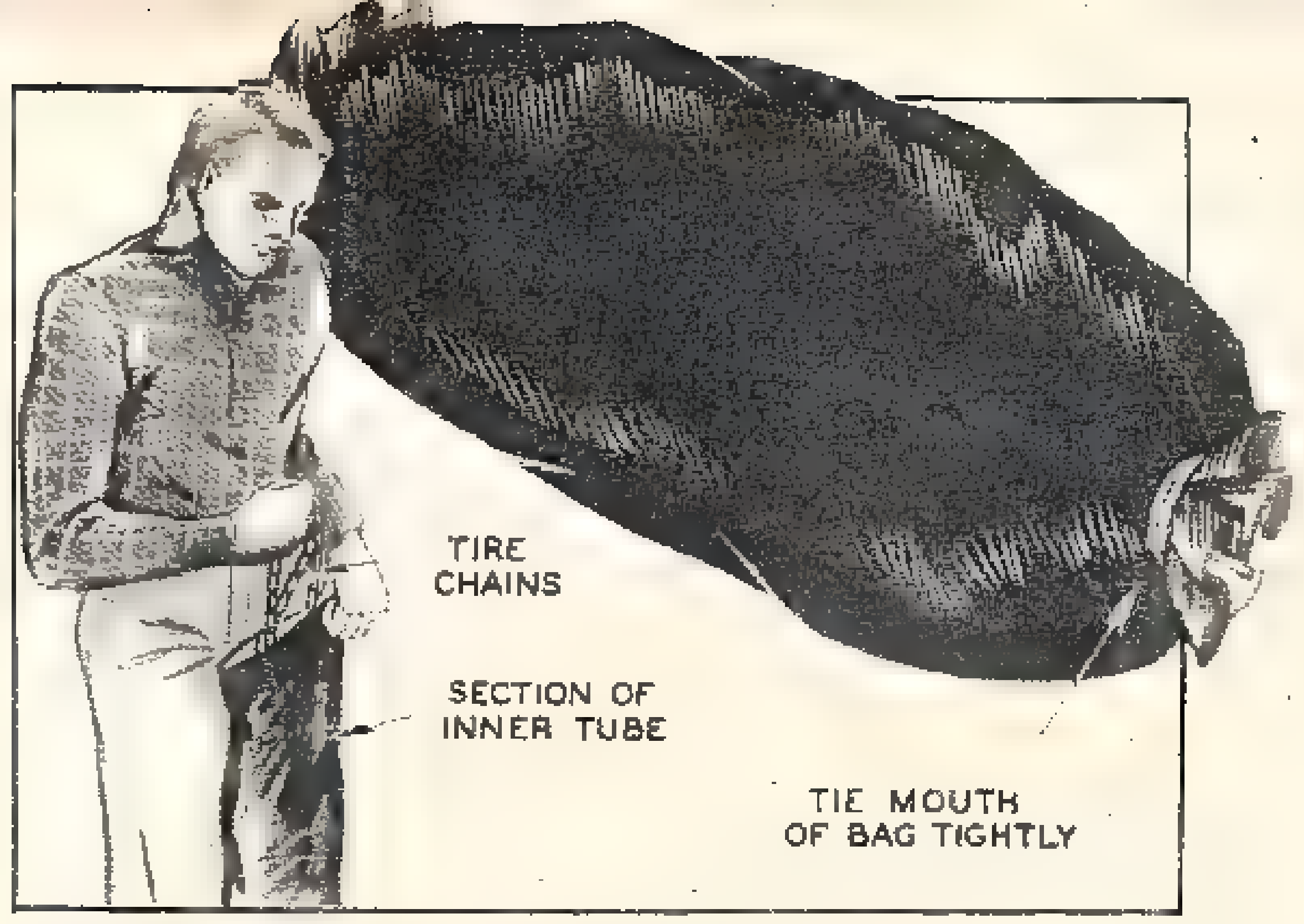

METAL BINDING STRIP
LINOLEUM
PINE TOP
DRAWER
DOOR STOP
DRAWER RAIL
SHELF
1-4" PLYWOOD PANEL
CLEAT
3-4"x2" PINE DOOR FRAME
CLEAT
CABINET FLOOR
BASE
CORRUGATED FASTENERS
3-4"x2" FRAME
1-4" PLYWOOD PANEL
RABBETED 1-4"

Details of the cabinet construction. Cabinet doors are mitered and secured with casein glue and corrugated fasteners. Although adding to the cost, chromium angle strips will improve the appearance of completed project. Careful drawer construction will prevent sticking and frayed nerves.

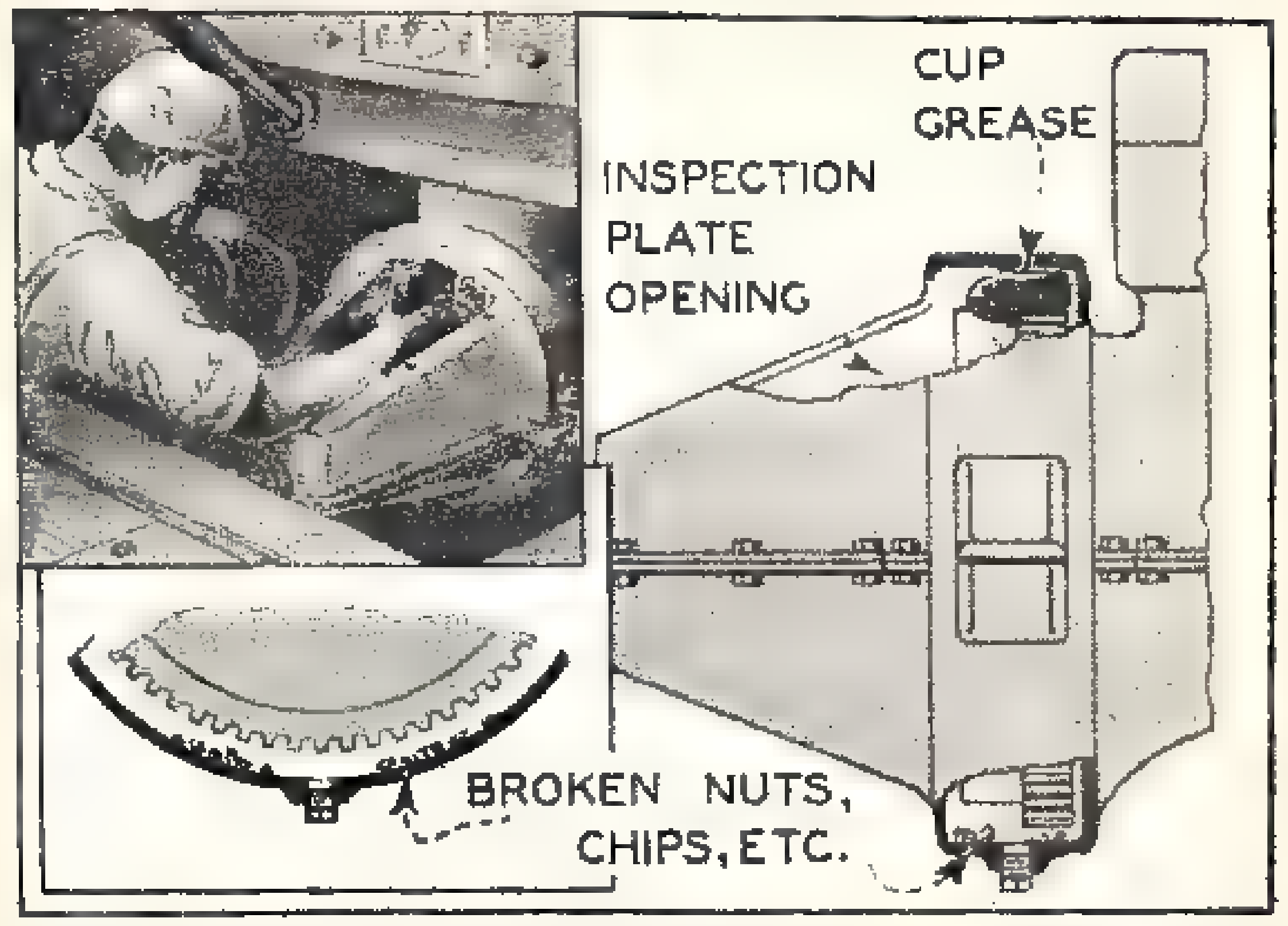
AUTO KINKS


END WRENCHES
BREAK IN CASING TO BE REPAIRED

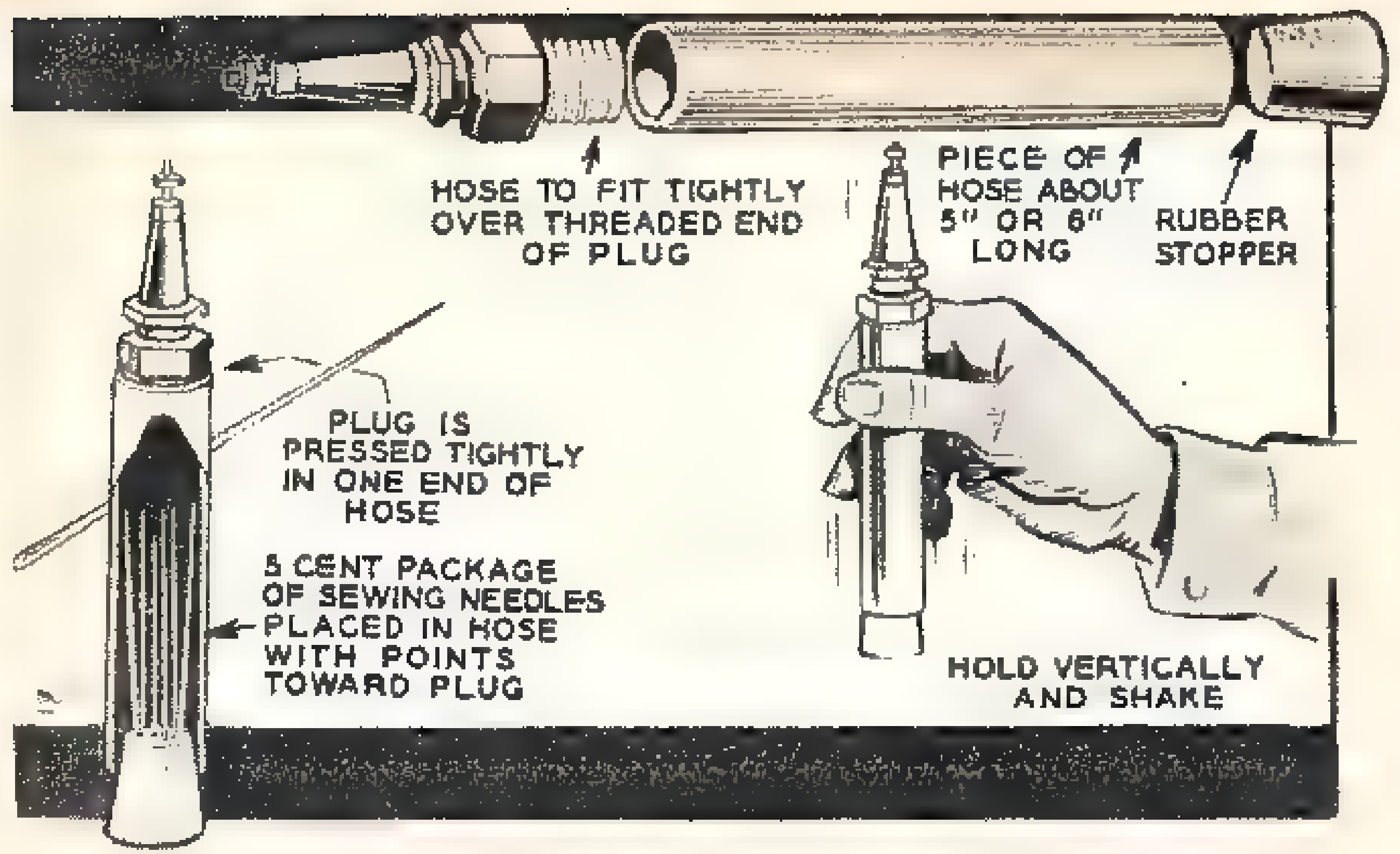
When making repairs to the inside of tire casings, at times it is difficult to keep the beads spread apart far enough to work satisfactorily. By inserting a small endwrench on each side of the portion to be repaired, this difficulty will be eliminated.—Vernon Tracy.


TIRE CHAINS
SECTION OF INNER TUBE
TIE MOUTH OF BAG TIGHTLY

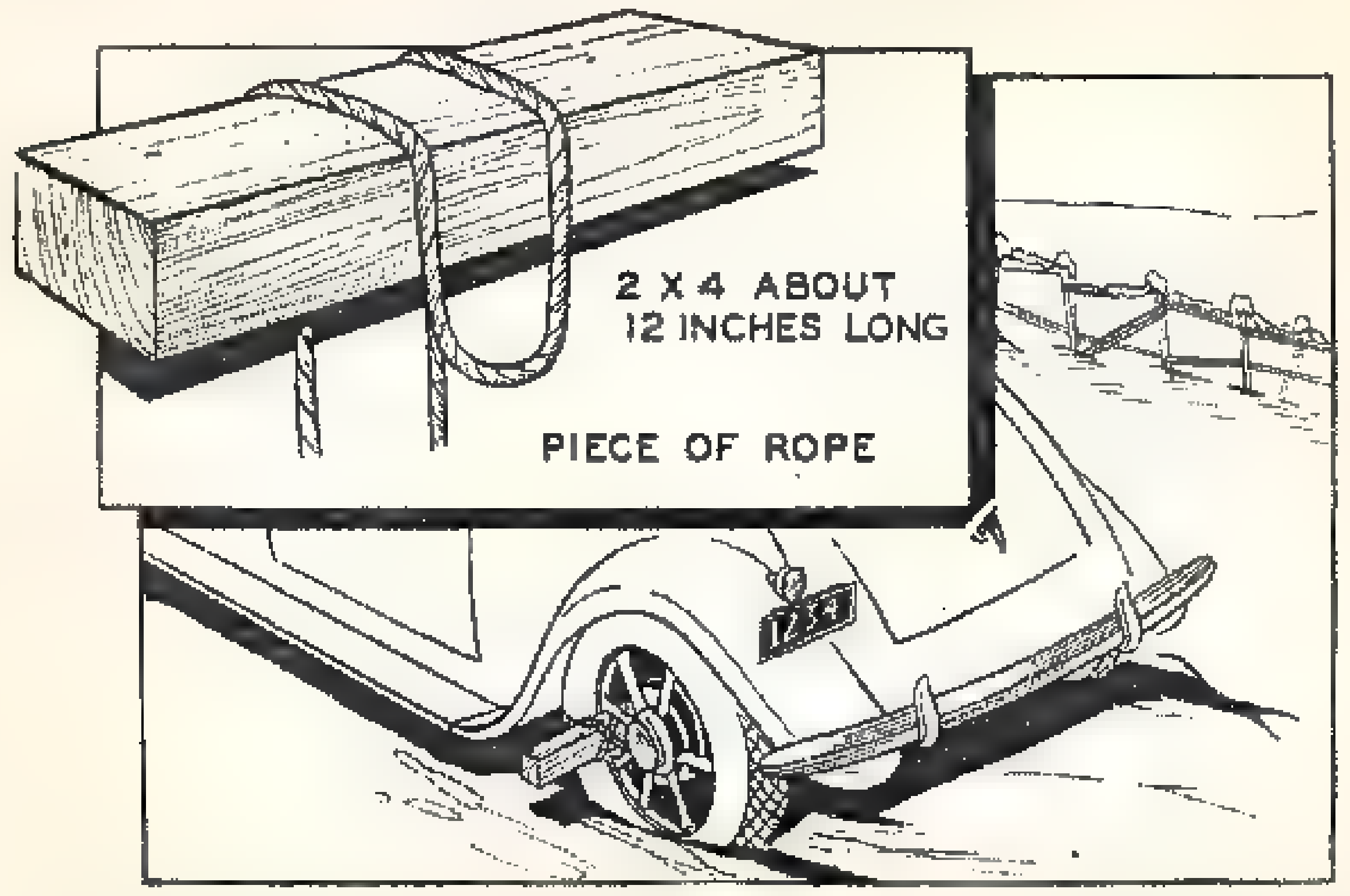
When tire chains are carried in the car, they often cause considerable noise when the car is driven over uneven road surfaces. This noise can be eliminated by carrying the chains in a bag made from an old inner tube.—H. V. Tracy.


CUP GREASE
INSPECTION PLATE OPENING
BROKEN NUTS, CHIPS, ETC.

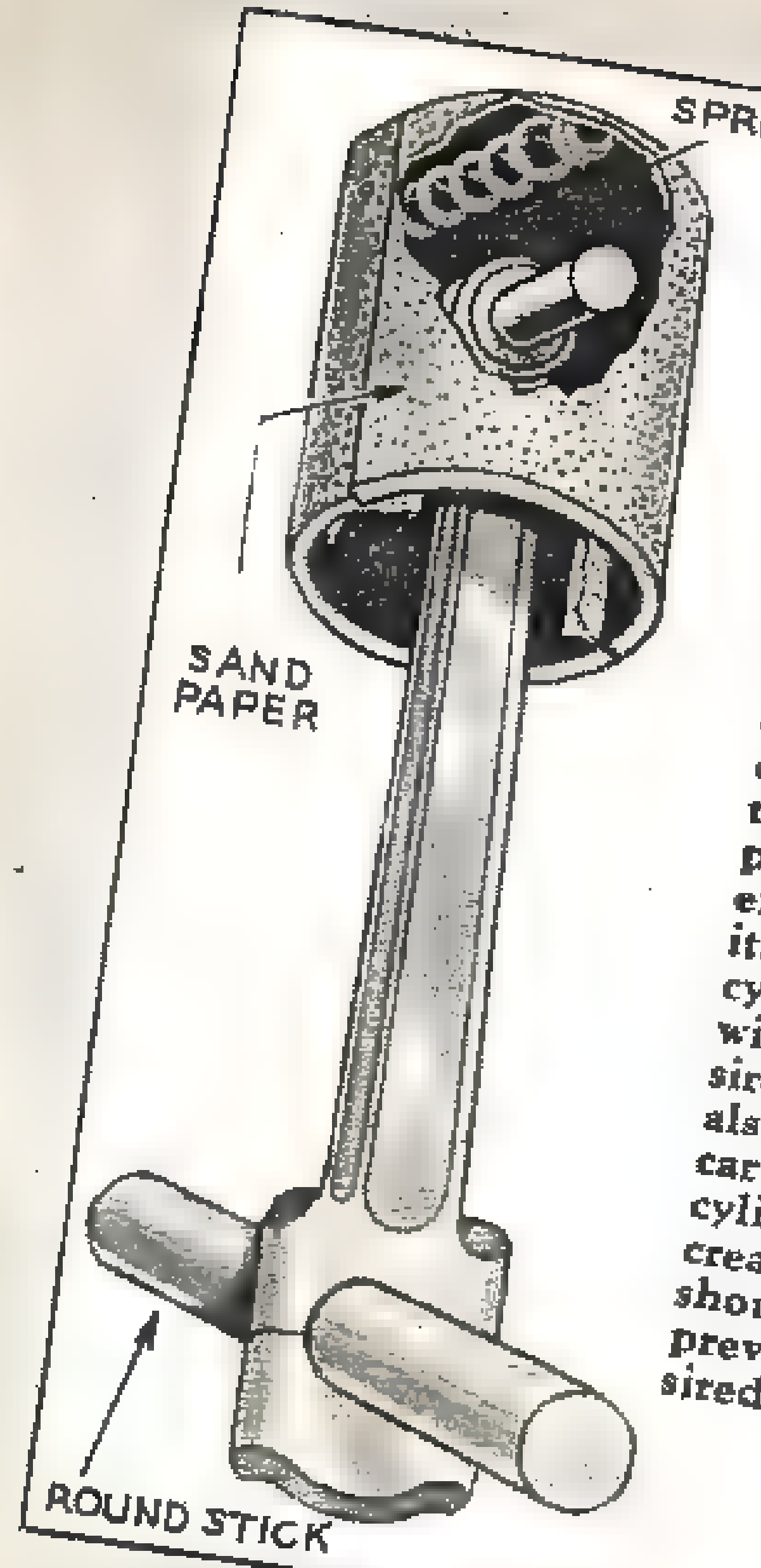
Occasionally broken bolts or small pieces of metal fall into the flywheel housing and are difficult to get out. They can be removed by opening the inspection plate and placing a large lump of cup grease on the flywheel gear. By turning the flywheel slowly the pieces of metal will stick to the grease as it passes around the housing.


HOSE TO FIT TIGHTLY OVER THREADED END OF PLUG
PIECE OF HOSE ABOUT 5" OR 6" LONG
RUBBER STOPPER
PLUG IS PRESSED TIGHTLY IN ONE END OF HOSE
5 CENT PACKAGE OF SEWING NEEDLES PLACED IN HOSE WITH POINTS TOWARD PLUG
HOLD VERTICALLY AND SHAKE

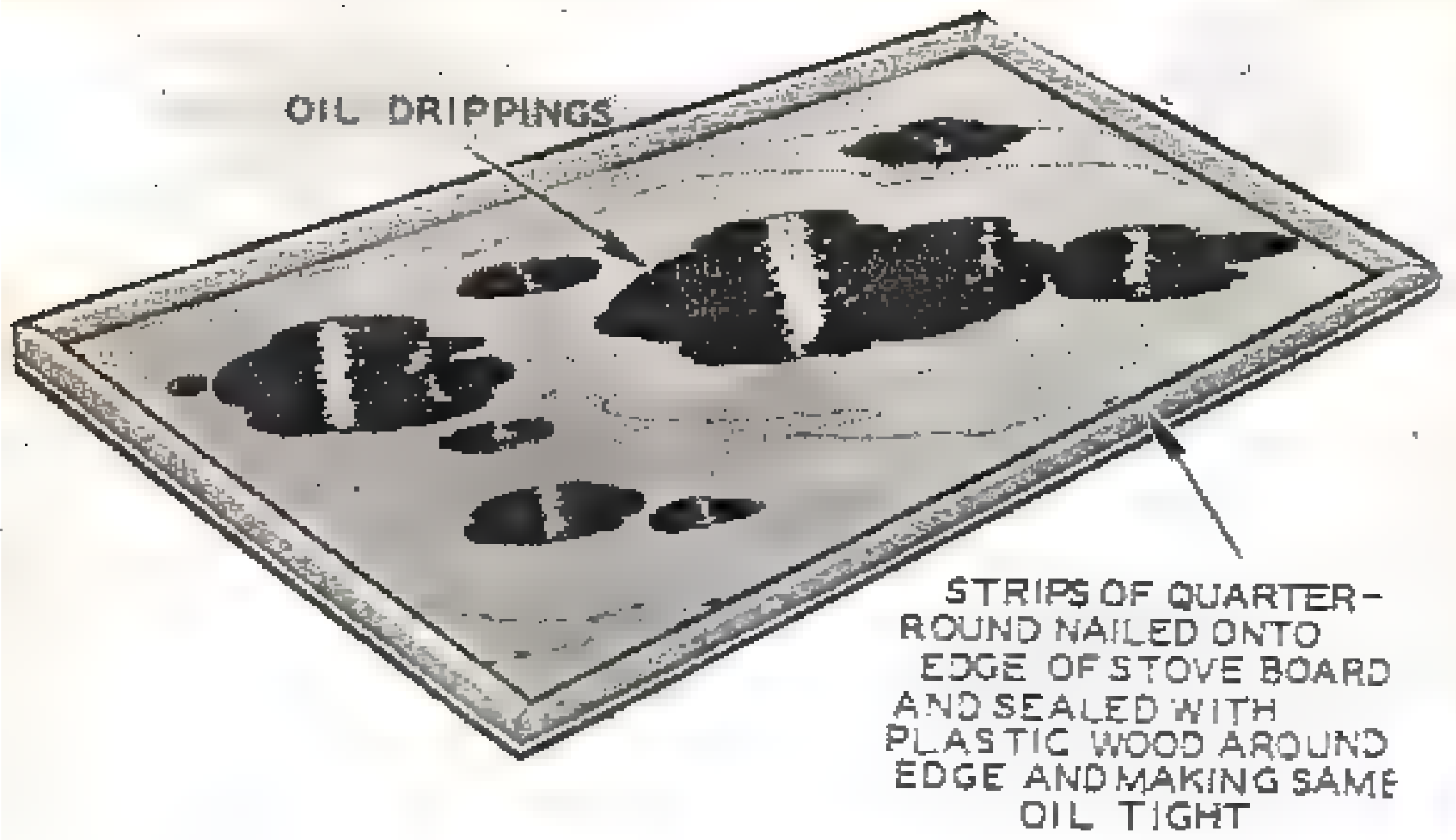
A short piece of hose, a cork and a few needles make a handy and efficient spark plug cleaner. The hose should have a diameter slightly smaller than the spark plug so that it will fit tightly. After the spark plug is in place, put in the needles and cork up to the other end.


2 X 4 ABOUT 12 INCHES LONG
PIECE OF ROPE

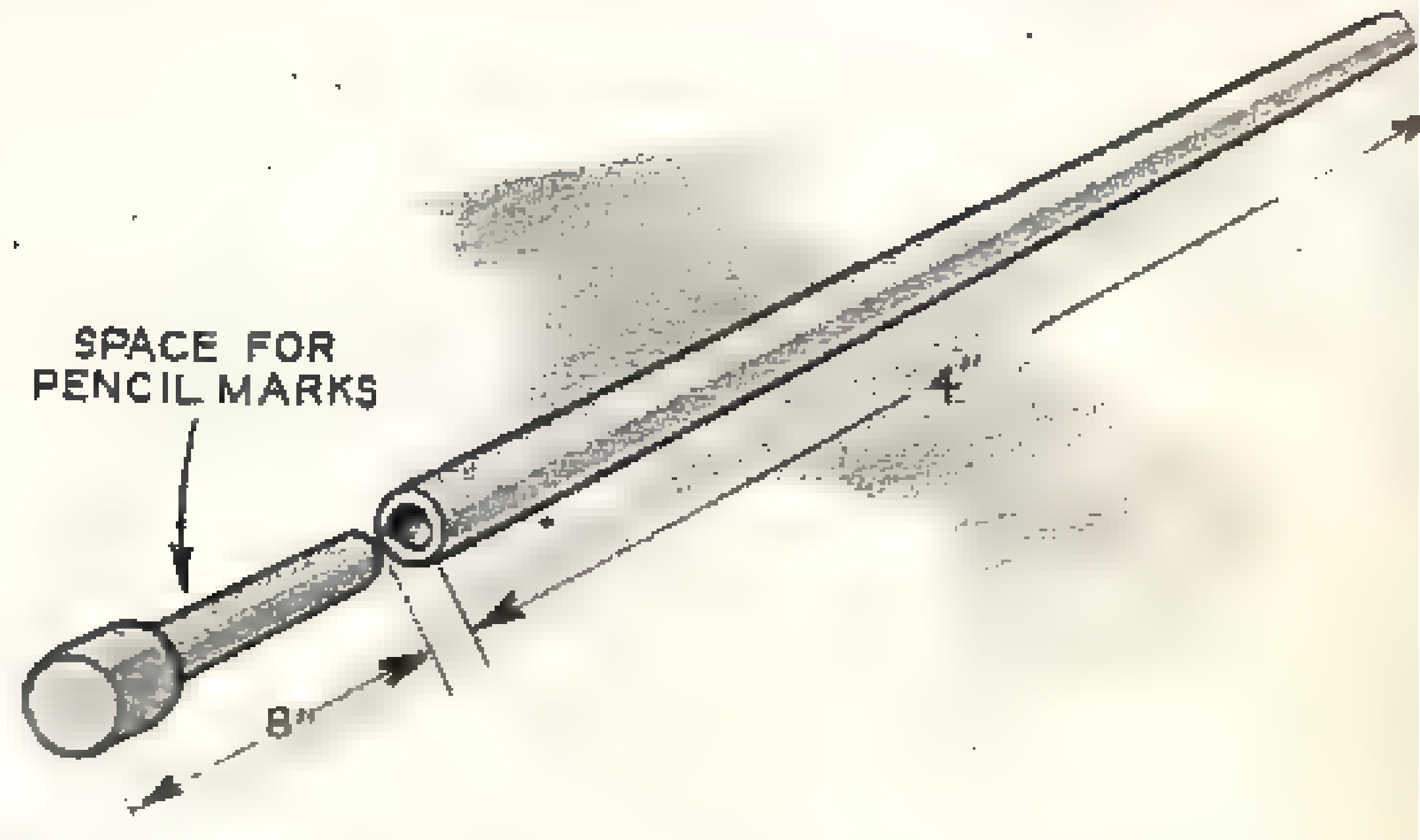
A 2 by 4 fastened to the rear wheels of a car as shown in the drawing will greatly speed the process of freeing a car when it is in a sand or mud hole. When starting be sure to do it slowly so that the wood will not strike the fender.—A. H.


SPRING
SAND PAPER
ROUND STICK

On Model A Fords whose cylinders have worn to a cone shape, this device will make it possible to hone down the bottom part so that it will take an oversize piston. A regular size piston should be split as shown in the drawing. Cover each side with emery cloth and insert one or two springs inside the piston so that they will exert their force to open it. When inserted in the cylinder, a rotary motion will bring it to the desired size. This method also can be used on other car engines when the cylinder size is to be increased. The worker should exercise caution to prevent more than the desired enlargement.—A. C. Hill.

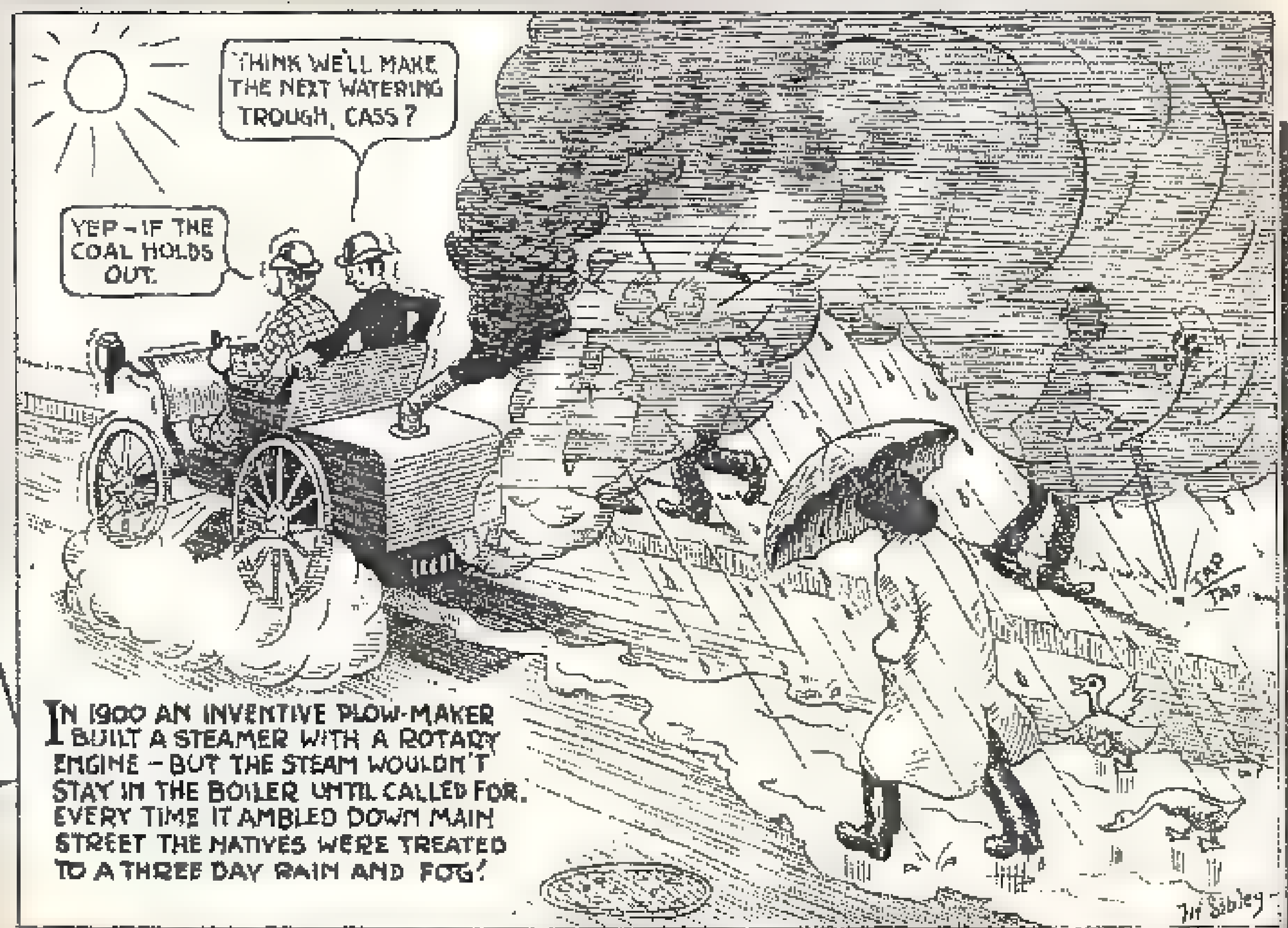

OIL DRIPPINGS
STRIPS OF QUARTER-ROUND NAILED ONTO EDGE OF STOVE BOARD AND SEALED WITH PLASTIC WOOD AROUND EDGE AND MAKING SAME OIL TIGHT

An old stove board makes an ideal drip board for use under a car in a garage. When a quantity of oil has dripped on it, it is a simple matter to wipe it off with a dry rag. If desired, old newspapers can be spread on the board and when they have soaked up all the oil possible, they can be disposed of by burning. Strips of quarter round should be fastened to the edges of the board.—Bob Poulson.

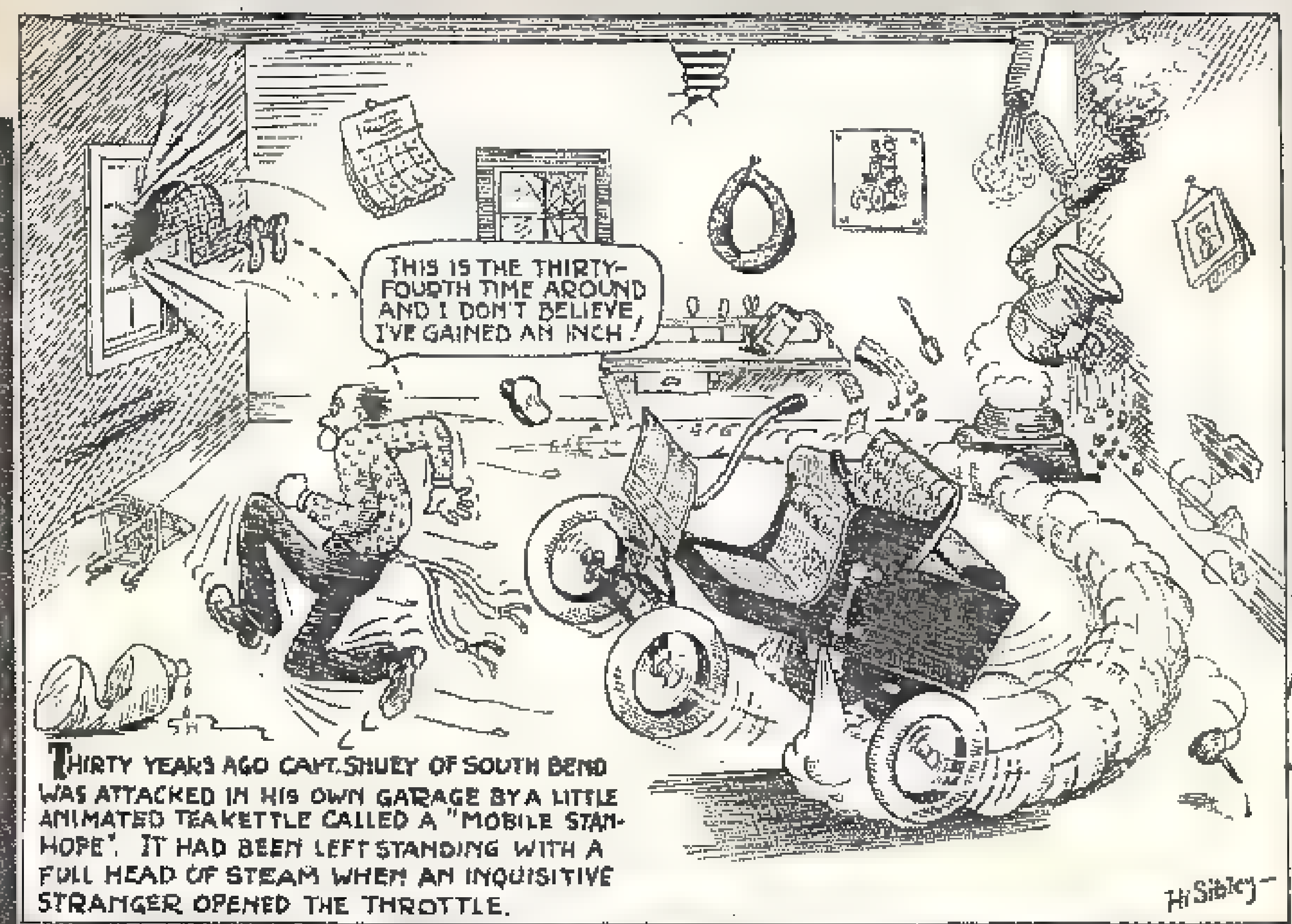

SPACE FOR PENCIL MARKS
4"
8"

The drawing shows a home-made measuring stick for measuring the toe-in of an automobile. Two wooden curtain rollers are spliced together. One end is cut square. A piece of wood is shaped as shown in the drawing, for the other end, from which the spring is removed. The small piece should be free to move in or out of the long strip, and can be marked when toe-in is checked.—A. C. Hill.

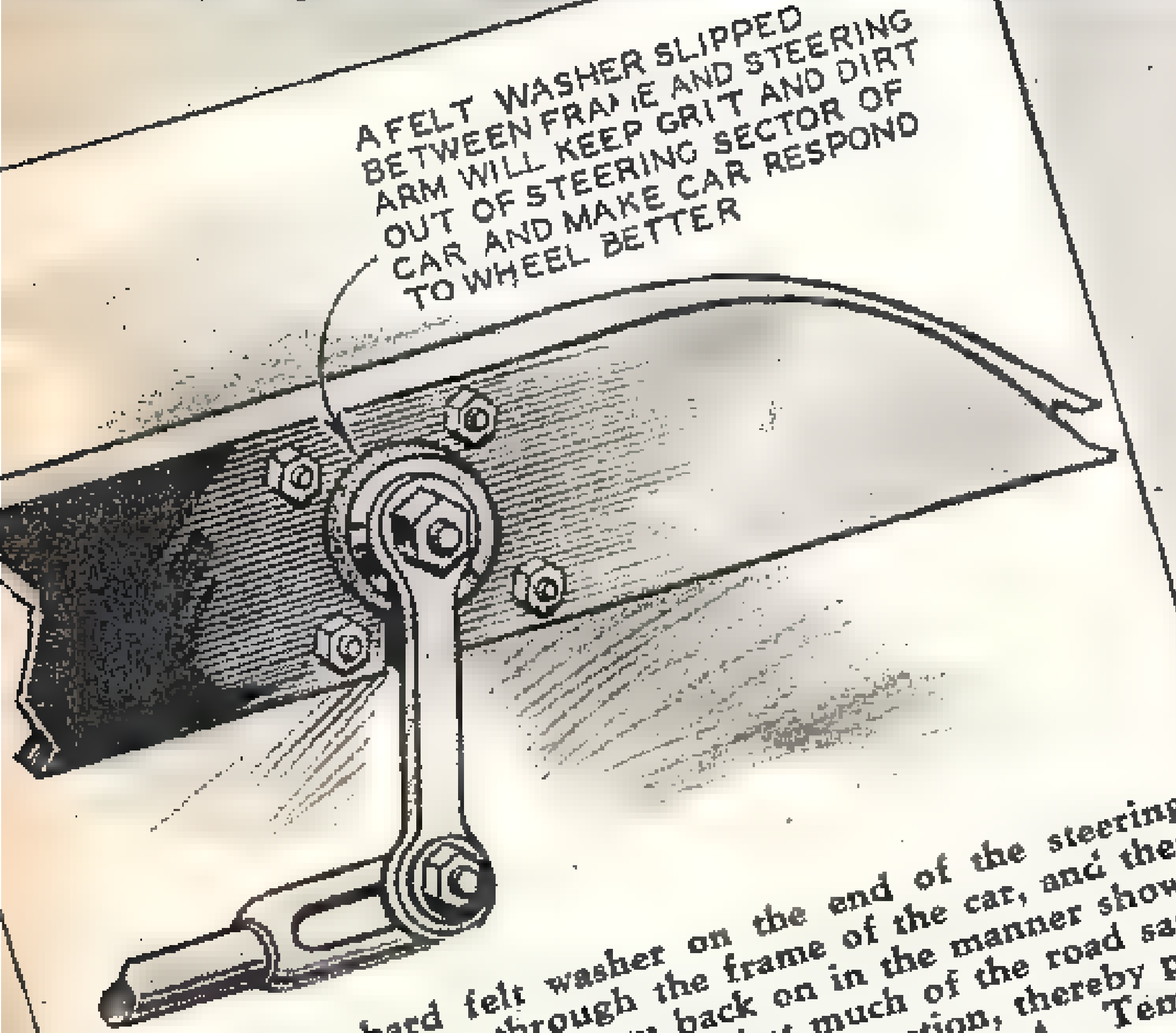
"Crankshaft Chronicles"


THINK WE'LL MAKE THE NEXT WATERING TROUGH, CASS?
YEP — IF THE COAL HOLDS OUT.
TAP TAP
Hi Sibley

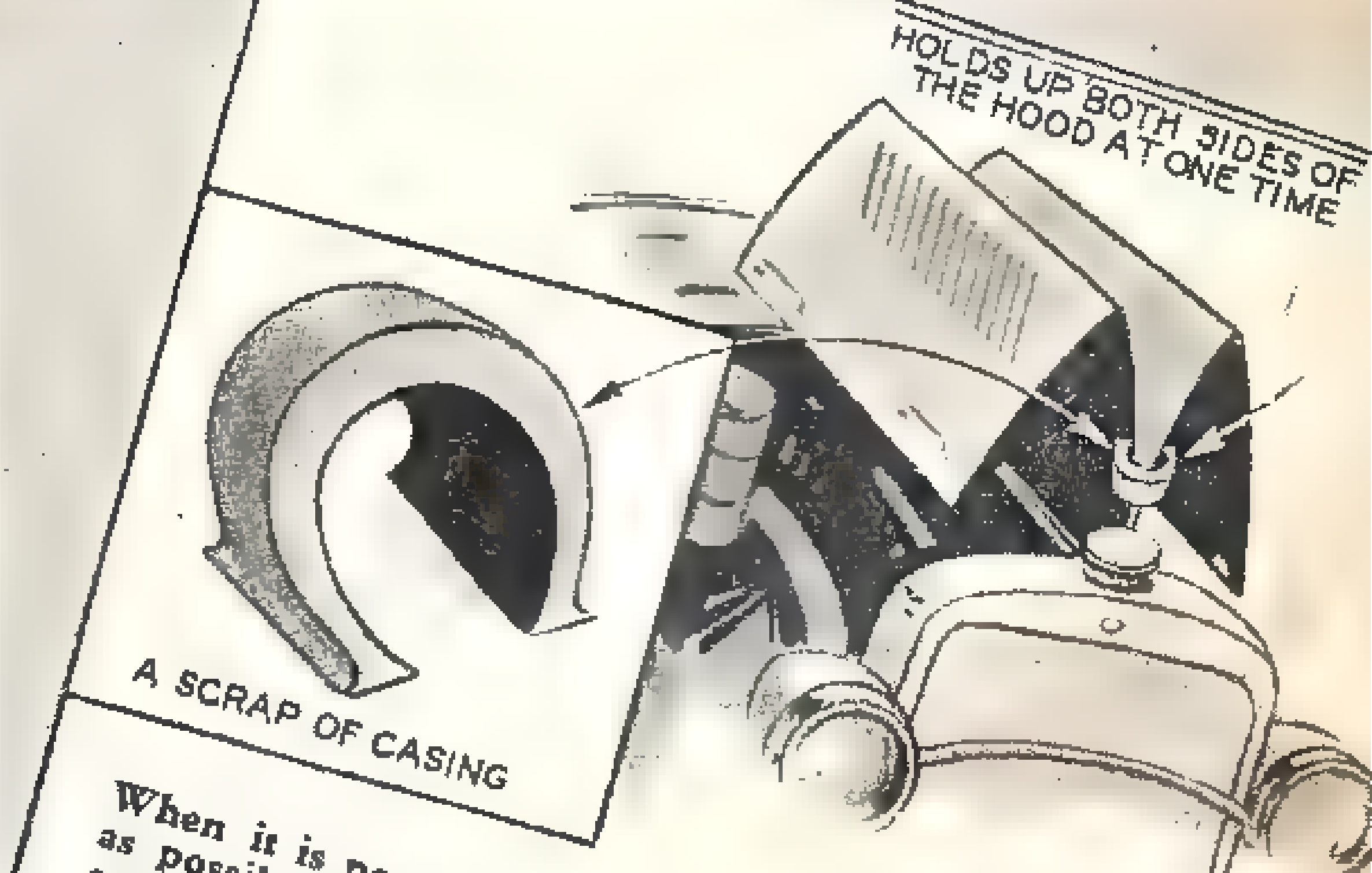
IN 1900 AN INVENTIVE PLOW-MAKER BUILT A STEAMER WITH A ROTARY ENGINE — BUT THE STEAM WOULDN'T STAY IN THE BOILER UNTIL CALLED FOR. EVERY TIME IT AMBLED DOWN MAIN STREET THE NATIVES WERE TREATED TO A THREE DAY RAIN AND FOG!


THIS IS THE THIRTY-FOURTH TIME AROUND AND I DON'T BELIEVE I'VE GAINED AN INCH!
Hi Sibley

THIRTY YEARS AGO CAPT. SHUEY OF SOUTH BEND WAS ATTACKED IN HIS OWN GARAGE BY A LITTLE ANIMATED TEAKETTLE CALLED A "MOBILE STANHOPE". IT HAD BEEN LEFT STANDING WITH A FULL HEAD OF STEAM WHEN AN INQUISITIVE STRANGER OPENED THE THROTTLE.


A FELT WASHER SLIPPED BETWEEN FRAME AND STEERING ARM WILL KEEP GRIT AND DIRT OUT OF STEERING SECTOR OF CAR AND MAKE CAR RESPOND TO WHEEL BETTER

By placing a hard felt washer on the end of the steering shaft that comes out through the frame of the car, and then placing the bell crank or arm back on in the manner shown in the drawing, it will be found that much of the road sand and dirt will be kept out of the steering section, thereby permitting the wheels to be turned easier.—A. Tempe.

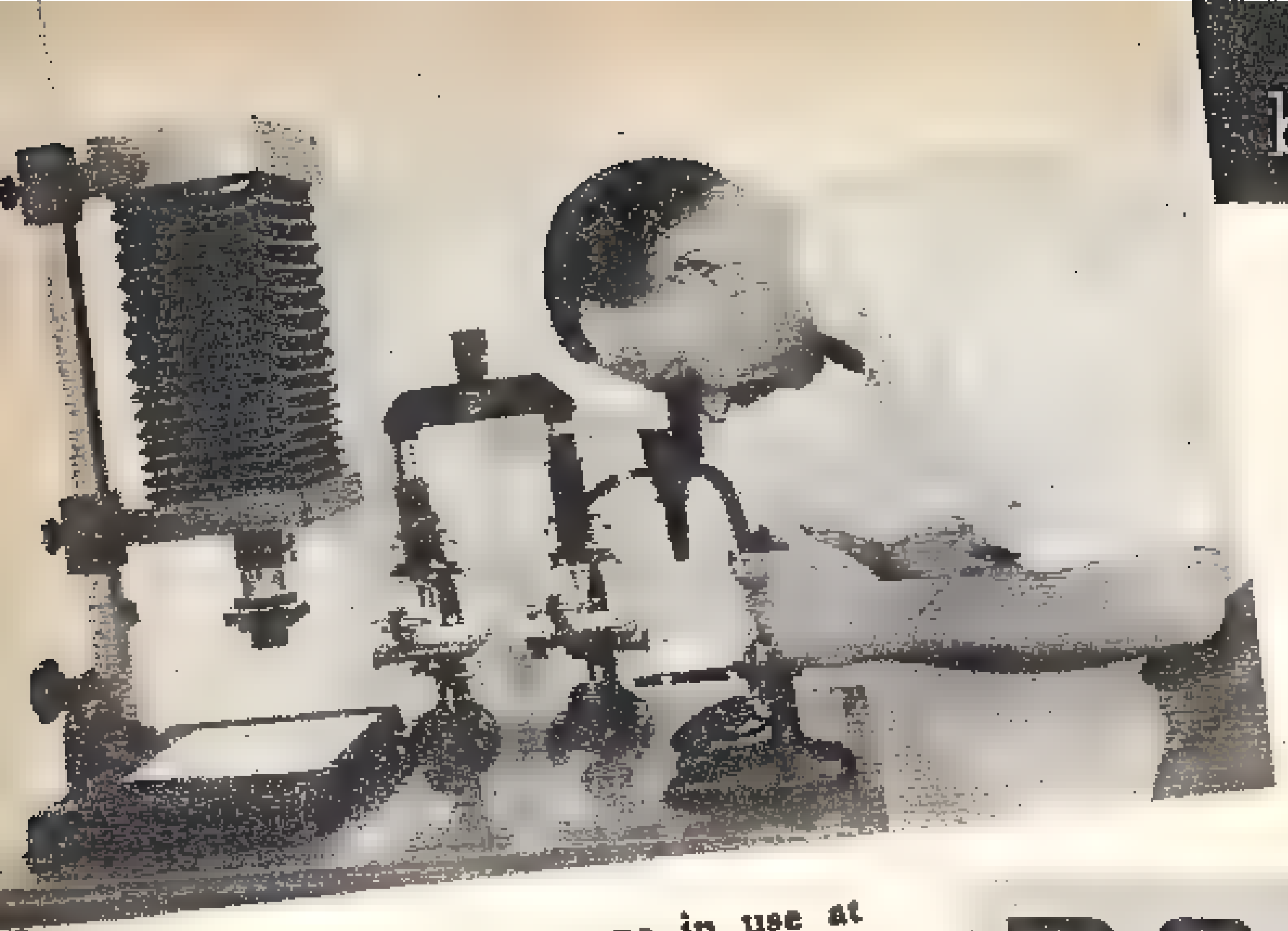

HOLDS UP BOTH SIDES OF THE HOOD AT ONE TIME
A SCRAP OF CASING

When it is necessary to hold an engine hood up as high as possible to be out of the way while working on the engine, a small piece of tire casing will be found satisfactory. If the hood is heavy, two pieces, one at each end, probably will be necessary.—A. H. Waychoff.

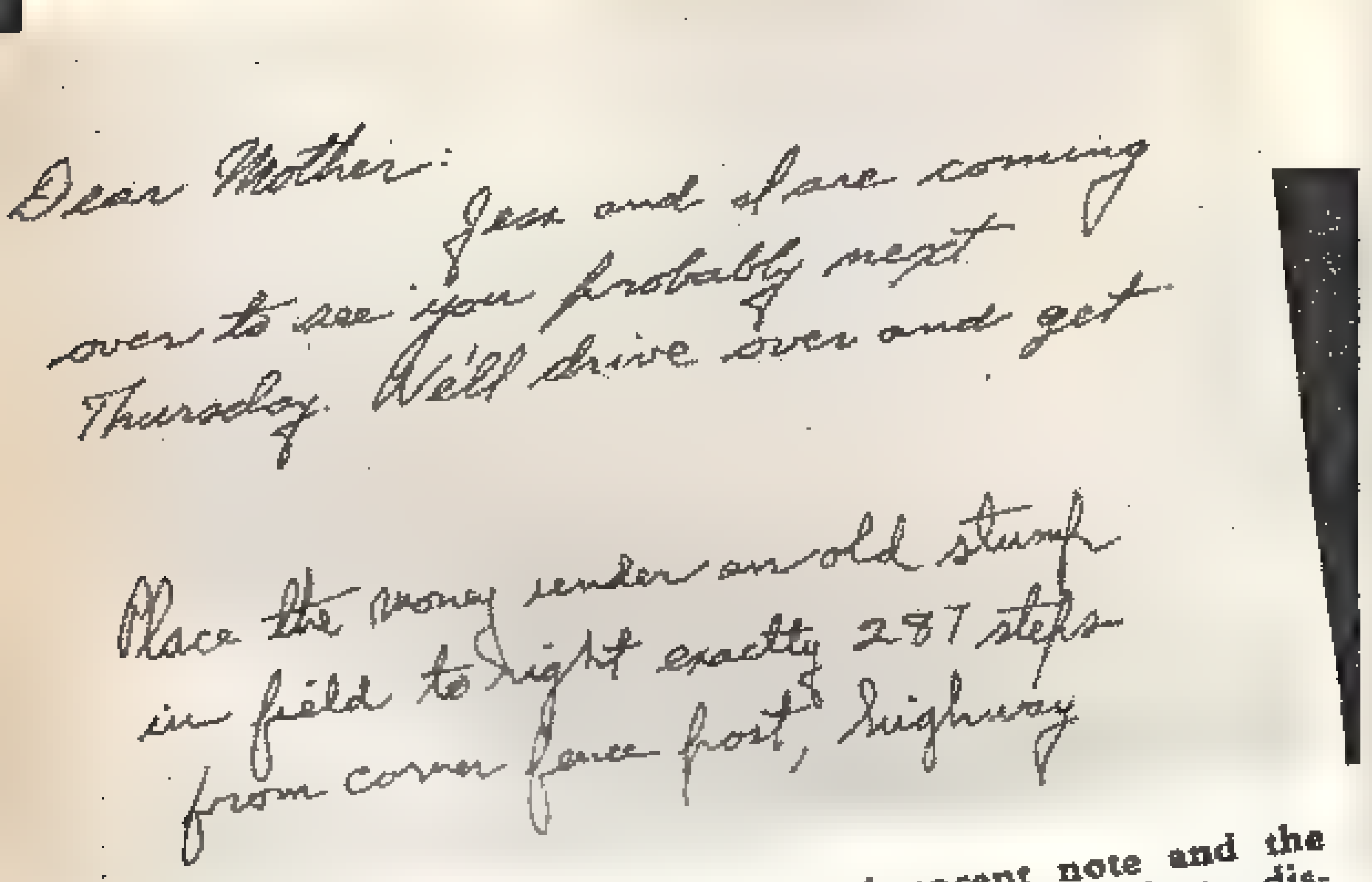
DOCUMENTARY EVIDENCE

by Julian D. Corrington, Ph. D.

The microscope shows glaring differences while naked eye sees duplicates.



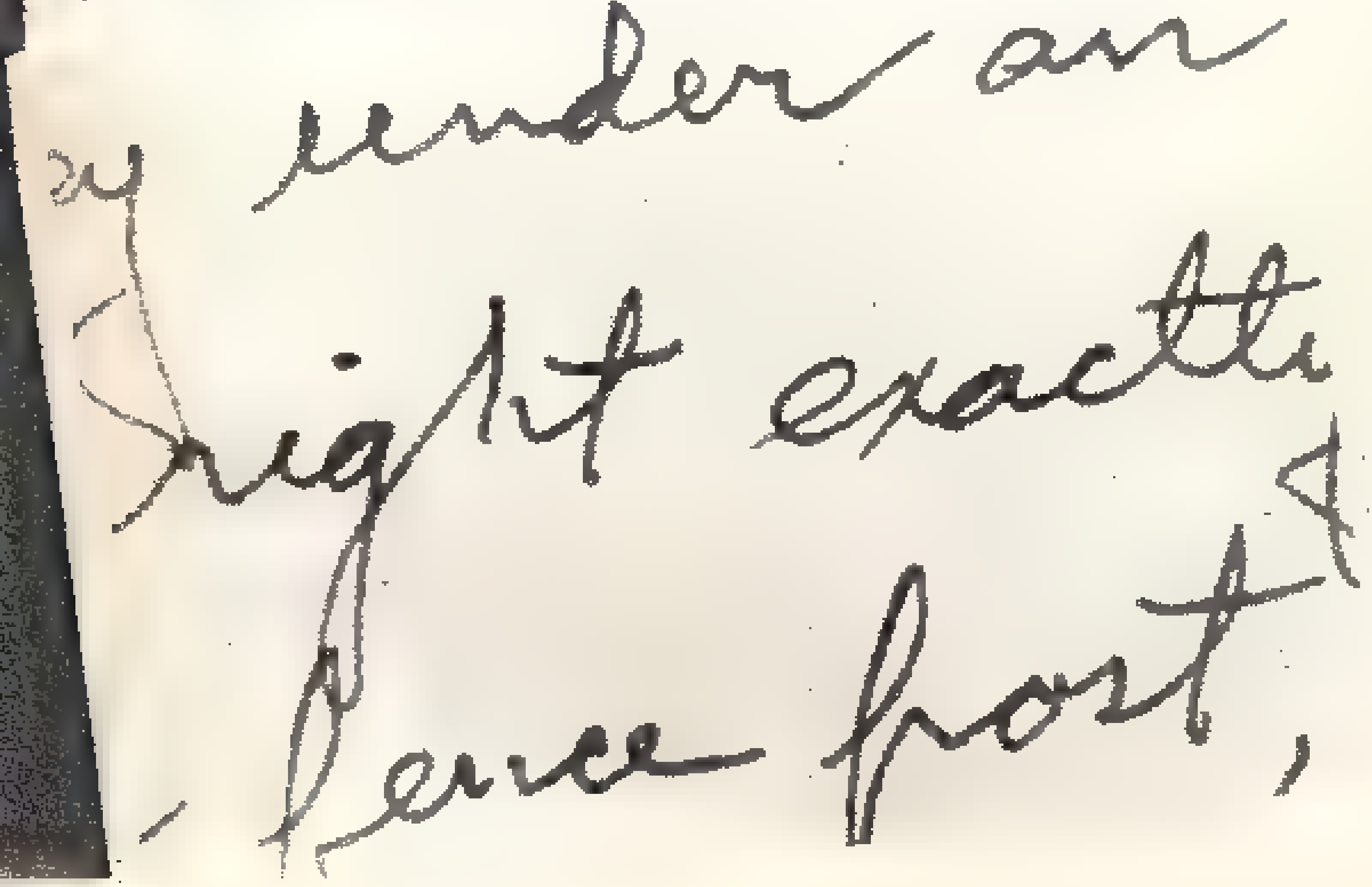
A binocular microscope in use at the sheriff's office, Bakersfield, Calif. Under the camera is a finger-print record. Double microscope in center is for bullet comparison.



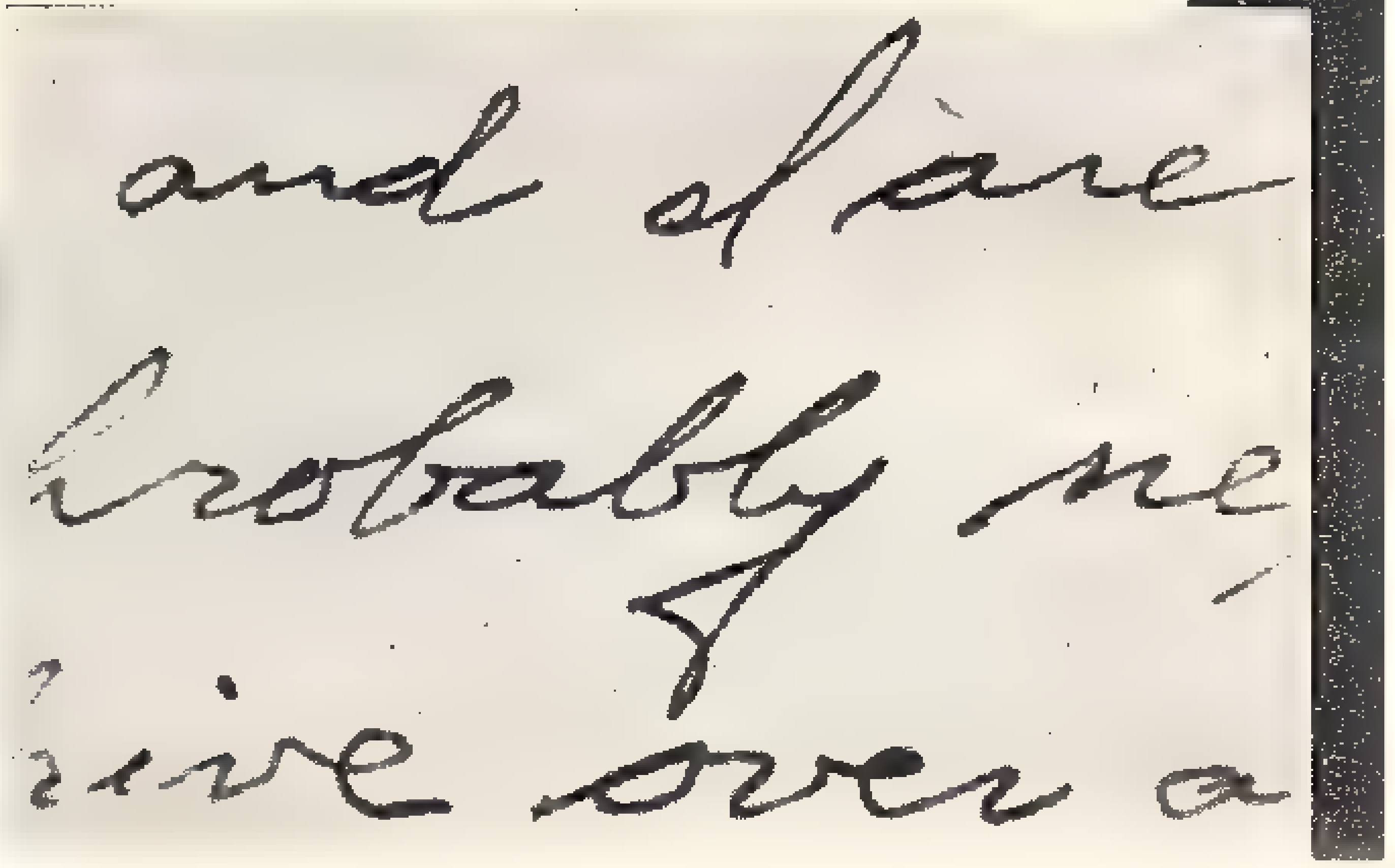
Dear Mother:
Jess and I are coming over to see you probably next Thursday. We'll drive over and get

Place the money under an old stump in field to right exactly 287 steps from corner fence post, highway

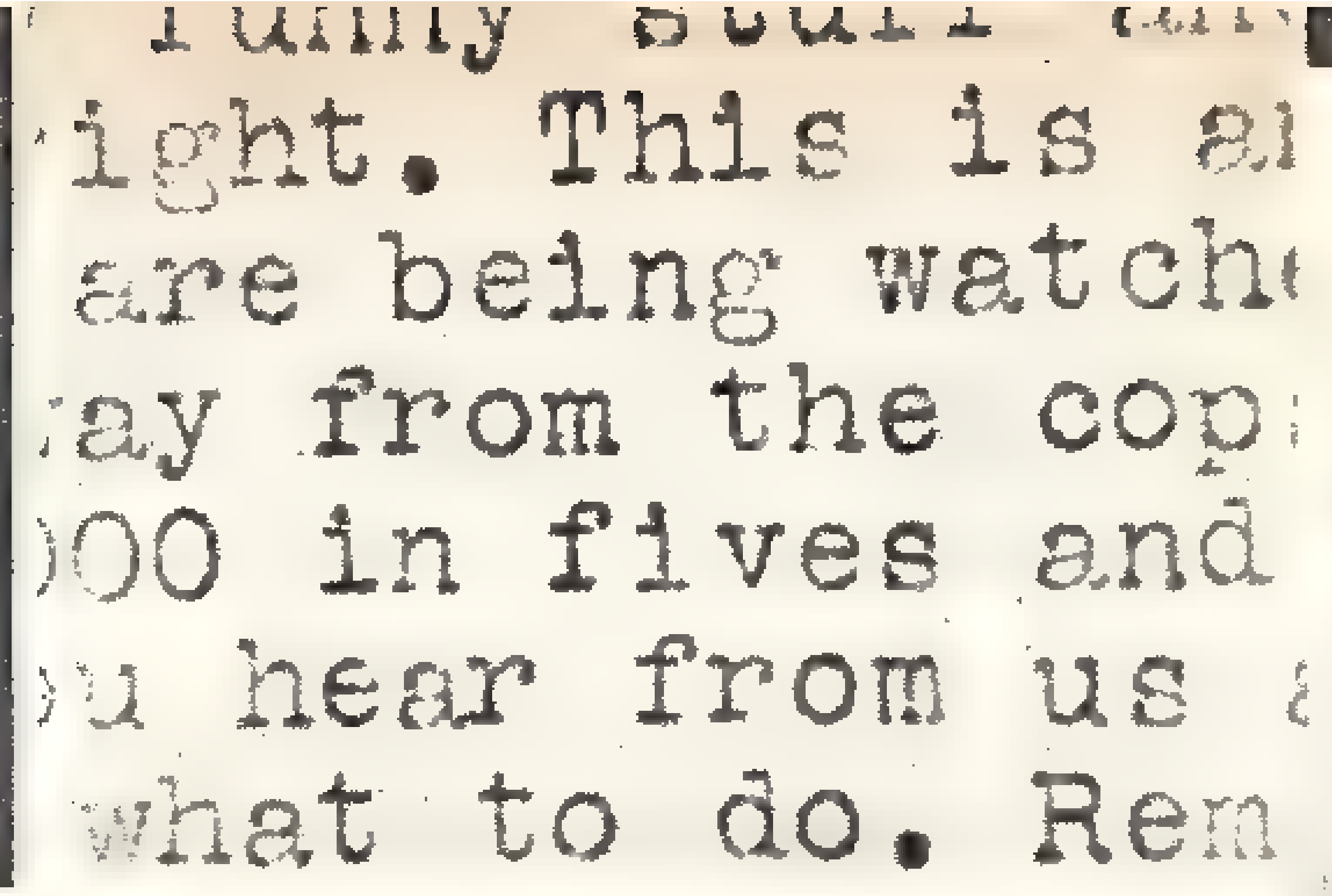
Samples of handwriting showing an innocent note and the same person's handwriting when an attempt is made to disguise it. Below is an enlargement of the disguised sample showing similarities to the innocent note. At right is an enlargement of writing when no disguise was attempted.



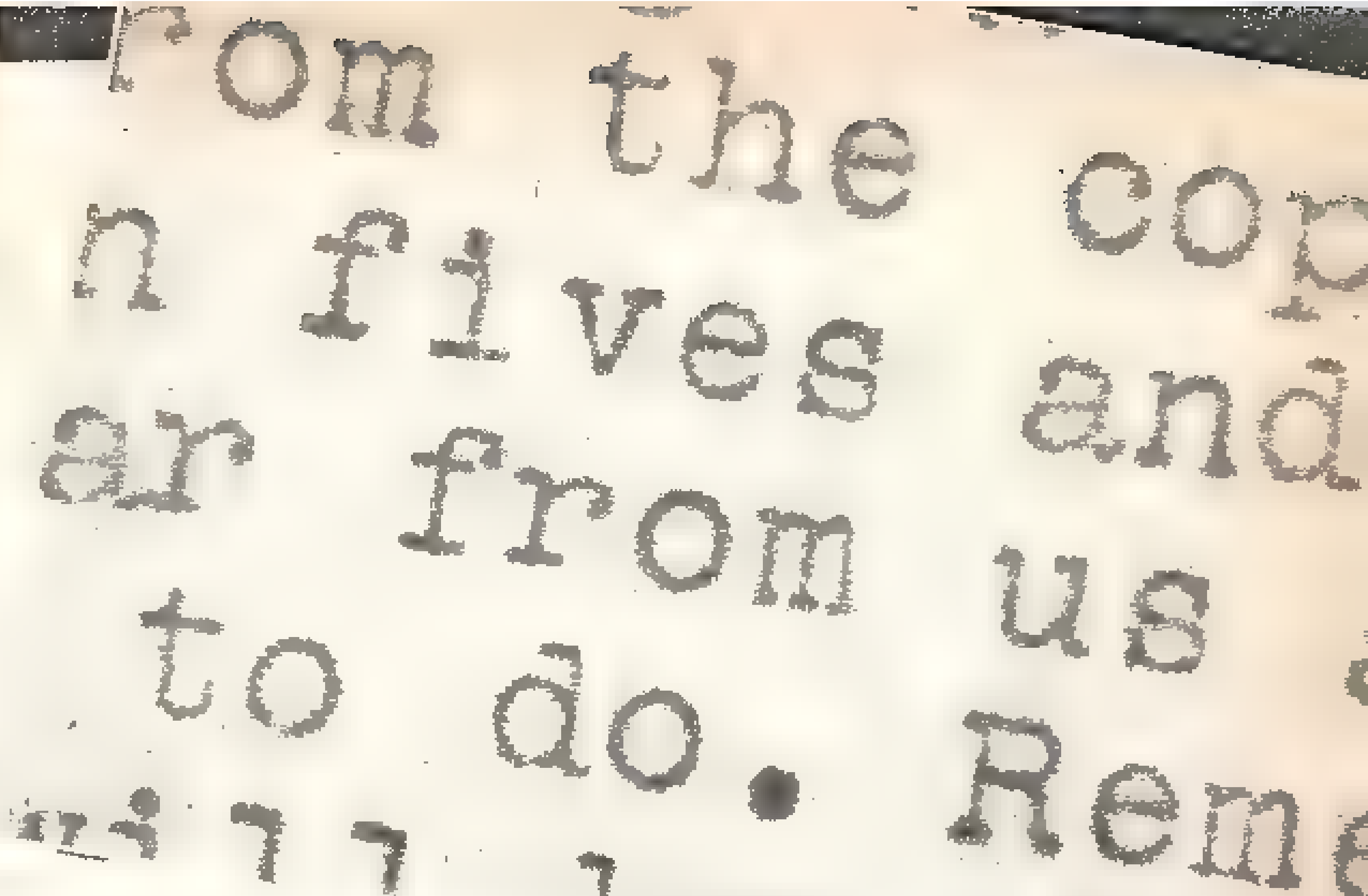
under an
right exacti
fence post,



and I are
probably ne
rive over a

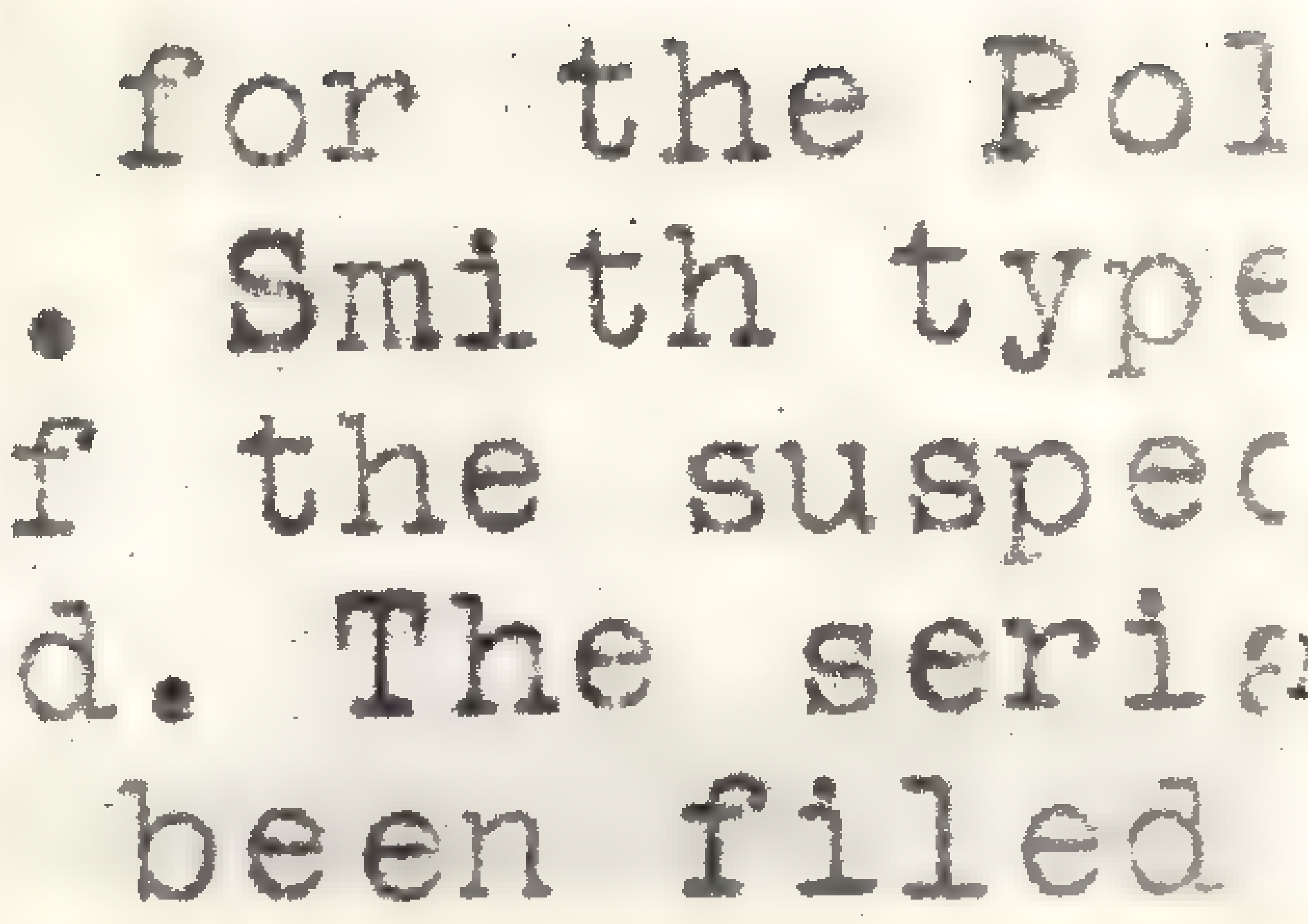


ight. This is a
are being watch
ay from the cop
00 in fives and
u hear from us
what to do. Rem



om the cop
n fives and
ar from us
to do. Reme

Above left—A portion of a typewritten ransom note. Above is the same sample but with greater enlargement. Notice how some of the letters have distinguishing characteristics which show up clearly under magnification.



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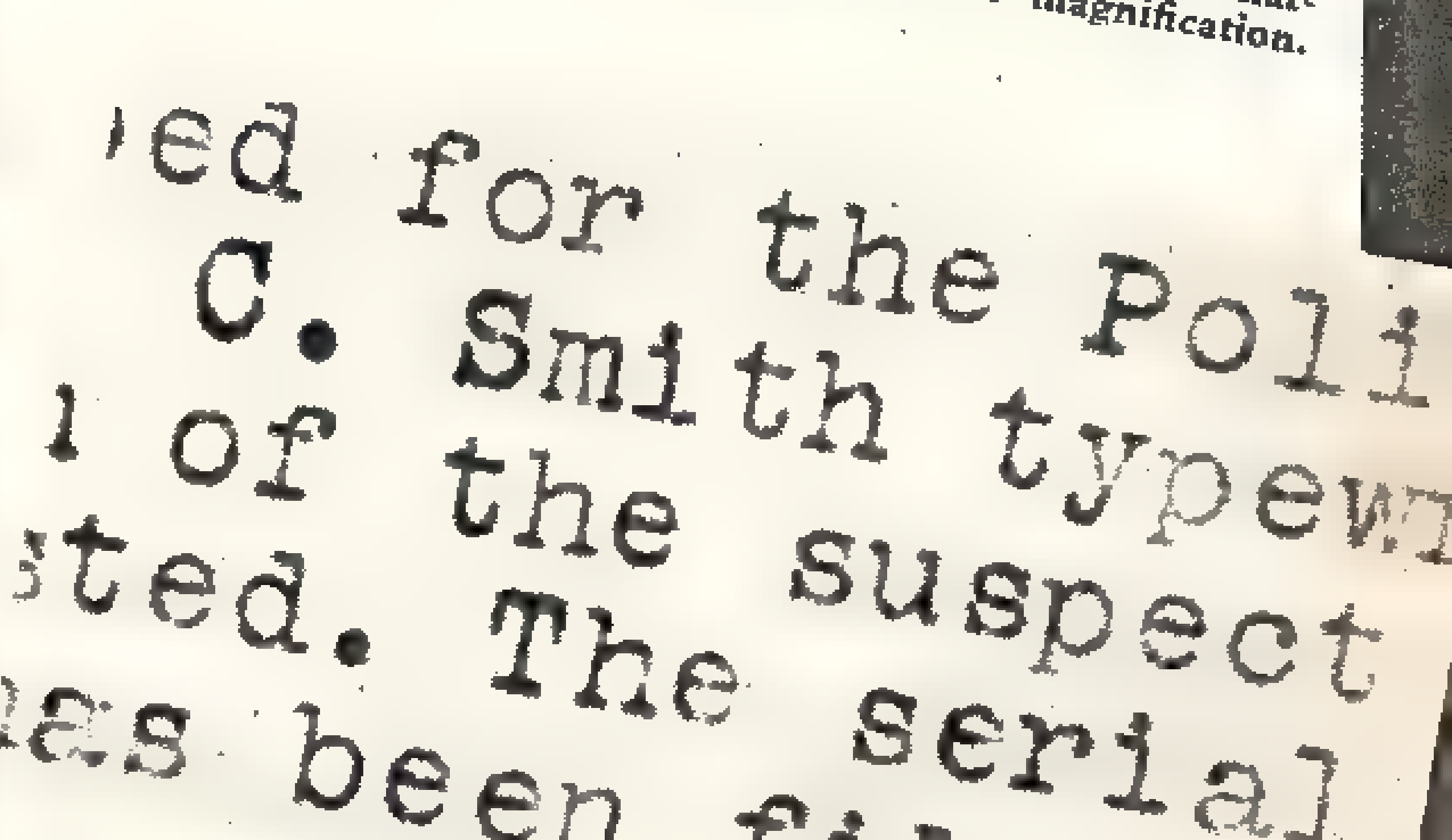
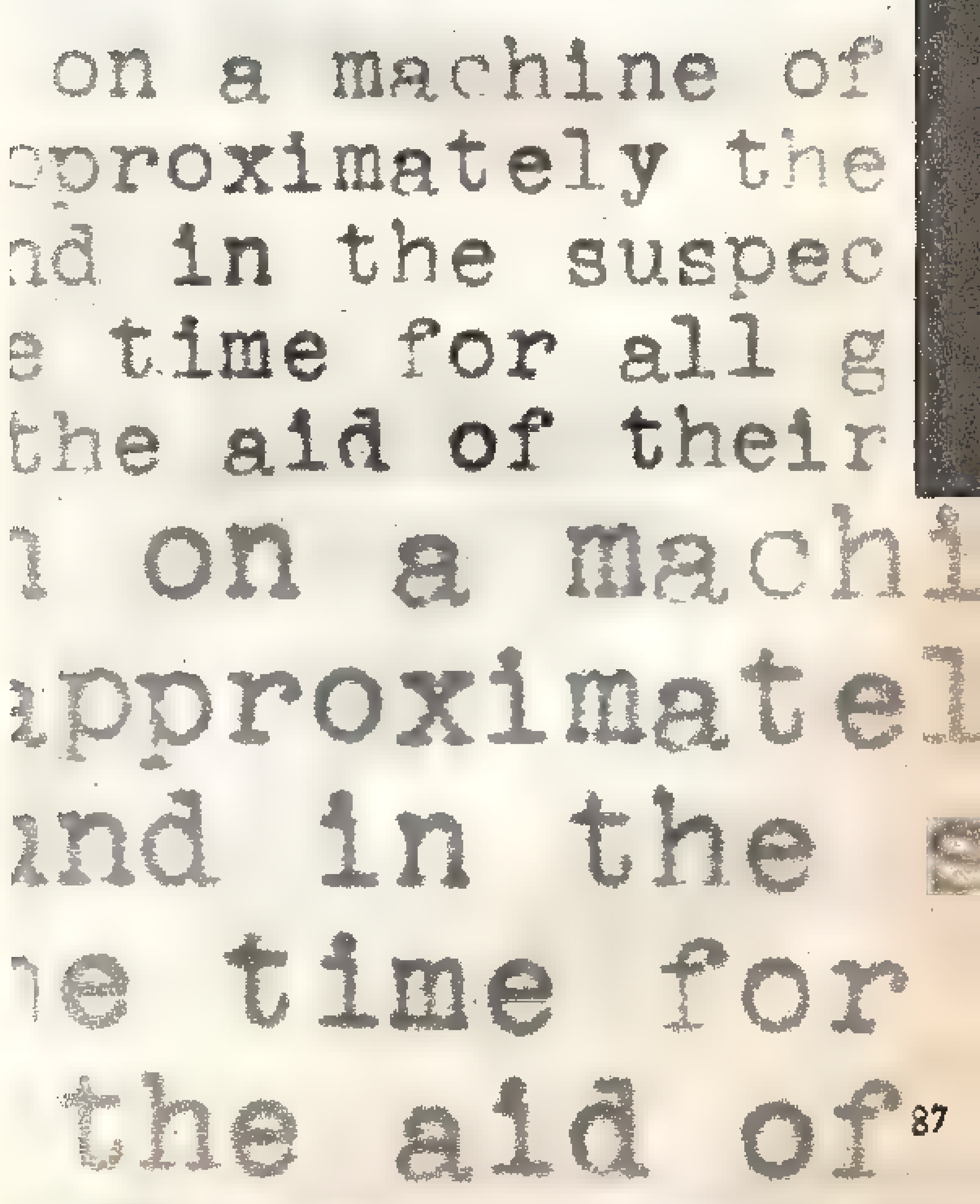
been filed



ed for the Poli
C. Smith typew
of the suspect
sted. The serial
as been filed

Above—Another example of a ransom note written on a different typewriter. At the left is an example of a similar note written on the same machine. Note the similarities in the letter "e" in both samples.

Below—An enlargement of the work of a machine having clear individual characteristics. Note top of letter "a." The line is unusually heavy. Also, the dot on the "i" runs into body of letter. Bottom—Same sample, greater enlargement.



on a machine of
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nd in the suspec
e time for all g
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the aid of

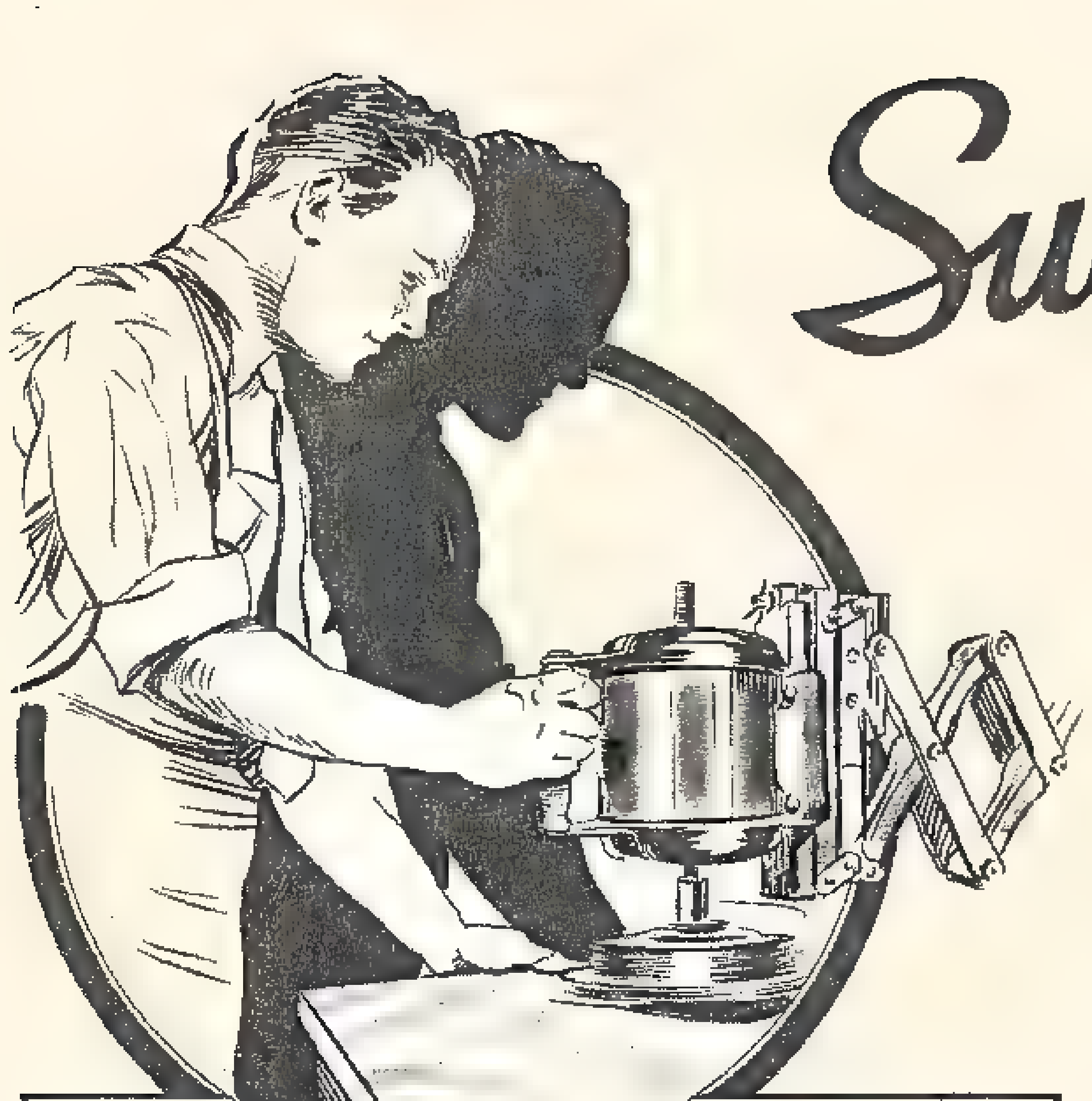
SUPPOSING you had done a successful job of kidnaping—successful, that is, up to the point where you were about to sit down and write the note demanding ransom. How would you go about this ticklish part of the procedure? Would you write it out longhand, print it by hand, or use a typewriter?

If you were very, very stupid, as so many criminals are, you might not even give a thought to this part of the business, or might conclude that the police could not possibly be smart enough to trace your handwriting; in either case you would be likely to write or print as best your limited education permitted. If you were a trifle less stupid but still far from wise, you might decide that handwriting is a give-away but that anonymity resides in the typewriter, and hence you would use such a machine should you have access to one. The really intelligent malefactor knows that, as a matter of fact, it actually doesn't make any difference—the scientific detective can easily trace any of the three forms of communication.

Documents comprise one of the major divisions in modern crime detection—a subject introduced in the preceding installment (in the March, 1938 issue) by detailing the fingerprint system of personal identification. There are still other chapters in criminology that are fascinating, but scarcely any more interesting than that having to do with tracing and identifying all forms of written or printed material, and entering nearly every type of crime from homicide and kidnaping through embezzlement and forgery to blackmail and poison-pen letters. We all get a big kick out of newspaper accounts telling how G-men traced a ransom note or ran down a notorious band of counterfeiters. Just how are these marvels of scientific sleuthing accomplished, and can we perform some experiments with our own microscopes that will simulate real cases and teach the methods?

Many channels of communication are open today, but handwriting is still one of the chief resorts of the criminal and its study forms a necessary part of training in criminology. It would be out of place here to describe individual traits of penmanship, but aside from constant differences in the shaping of separate letters, there are characteristic methods of spacing, punctuation, sentence formation, choice of words and the like that are as diagnostic as the Bertillon system of physical measurements.

Most of these points are discernible with the unaided eye, but low-power magnification—as with a reading glass, fingerprint reader, hand lens or binocular microscope—brings out the differences much more forcefully. Such aids to vision are constantly in use in examining documents and those who wish to study applications of the microscope



Swinging ARM SANDER you can make

Easily constructed tool solves problem of sanding large areas with little effort.

by Dick Cole

HERE is a home-made, motor-driven tool which will appeal to every cabinet maker and home-workshop enthusiast. It solves the problem of machine-sanding large surfaces. It is powered with a ¼ h. p. or ⅓ h. p. motor and will turn out excellent sanding jobs on big table-tops, dresser-tops, large panels, wide boards, etc. It eliminates the laborious task of hand sanding, which is probably the most unpleasant part of woodworking.

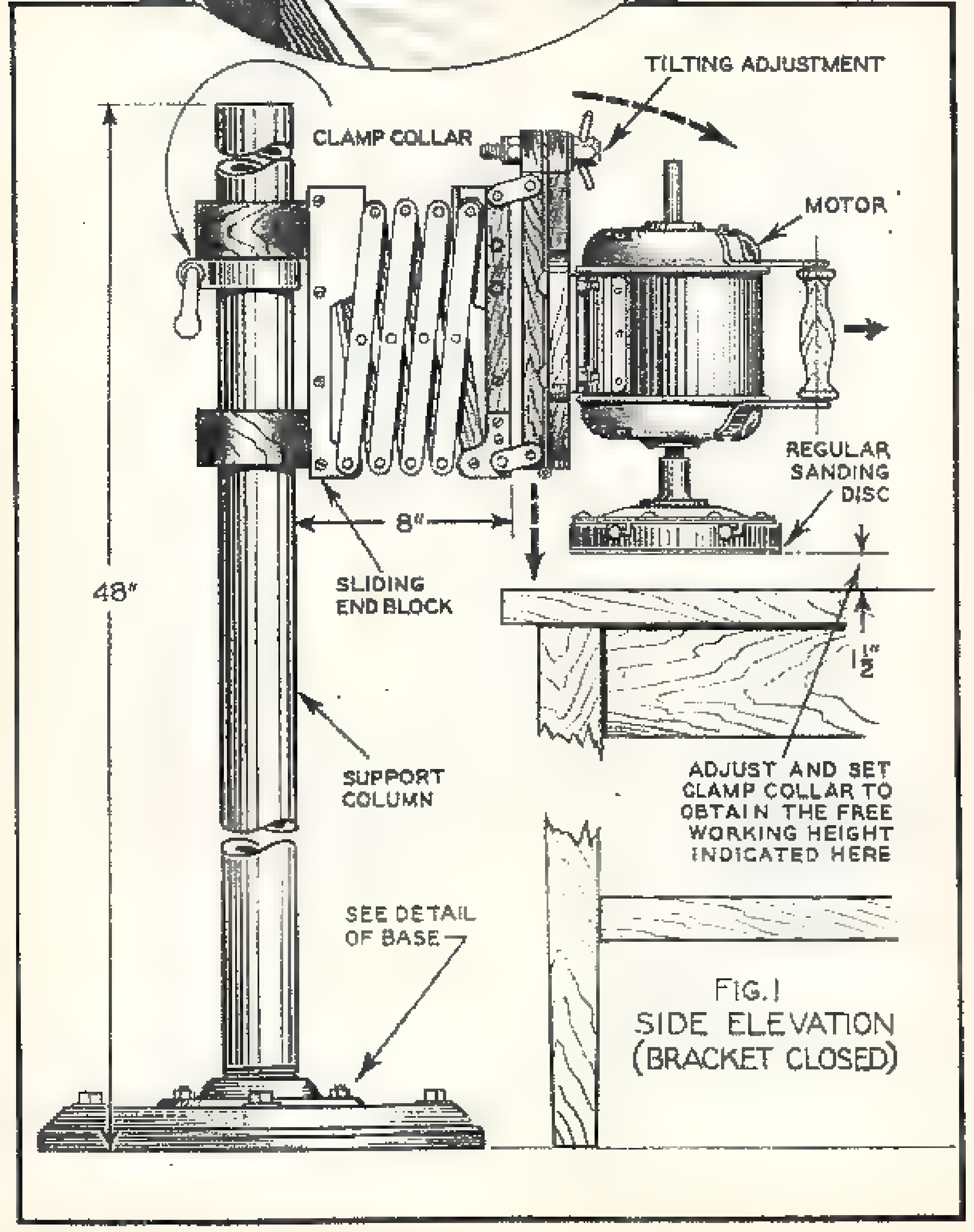

TILTING ADJUSTMENT
CLAMP COLLAR
MOTOR
48″
REGULAR SANDING DISC
8″
SLIDING END BLOCK
1½″
SUPPORT COLUMN
ADJUST AND SET CLAMP COLLAR TO OBTAIN THE FREE WORKING HEIGHT INDICATED HERE
SEE DETAIL OF BASE

FIG. 1 SIDE ELEVATION (BRACKET CLOSED)

The construction and operation of the sander are visualized in Figs. 1, 2 and 3. It will be seen that the sanding disk is mounted directly to the end of the motor shaft. The motor itself is mounted vertically at the end of a parallelogram type extension bracket, which, in turn, is free to swing on the tubular supporting column. Thus the sanding disk is always parallel to the surface to be sanded and can be moved over a wide area.

An objection to a disk-type sander—that it leaves circular scratches on the job—is overcome by using a bevel-face disk to finish off the work. The disk is moved with the grain of the wood and produces a first-class job.

The swinging arm sander is intended to be mounted directly to a drill-press column. When not in use, it can be swung to the side, and will not impede any of the usual drill-press operations.

If one does not have a suitable drill-press, then a column must be made as shown in the drawings. This consists of a 48″ length of 2¾″ iron pipe, dressed down to 2½″ outside diameter, and tightly screwed into a 2½″ floor flange. This is mounted on a 16″ wooden disk, which, in turn, is secured to the floor with lag-screws. The base is actually built up of two ¾″x16″ disks glued together with grain opposed. Hardwood is recommended for the base, but ordinary pine will serve.

We now come to the construction of the extension bracket itself. If the prospective builder will check each individual part against the plans and the photographs, he will glean a complete understanding of the construction of the assembly. Now let us start building the bracket from the column end outward. First we have the sliding end-block. It will be seen that this is built up of select maple into a composite unit (Fig. 3). It is well to bore the holes on a lathe for accuracy. If desired, these holes can be bushed with a brass ring, but the bushings will serve very little purpose. The maple alone is amply strong and, when polished and greased, makes an excellent bearing surface.

In any parallelogram type extension bracket one end of the arms at each end of the bracket must be free to have vertical movement. On this bracket the end arms are attached to a cross-shaft with rollers which travel in a channel made of $\frac{3}{32}$″x1¾″x1¾″ angle iron. The formation of these channels is clearly shown in the detail of the sliding end-block. The elevation of the bracket on the column is set with the simple clamp collar shown in Fig. 3.

The middle arms of the bracket are of select maple. Fig. 3 shows the special arm used at the column end of the bracket. It will be seen that a $\frac{5}{16}$″ rod, with a roller on each end, passes through the arm. The rod

Right—Drawing of the sander completely assembled. Note that when the bevel-faced disc is used, the mounting is tilted to correct angle for flat contact with work. Below — The completed sander mounted on a drill press column.

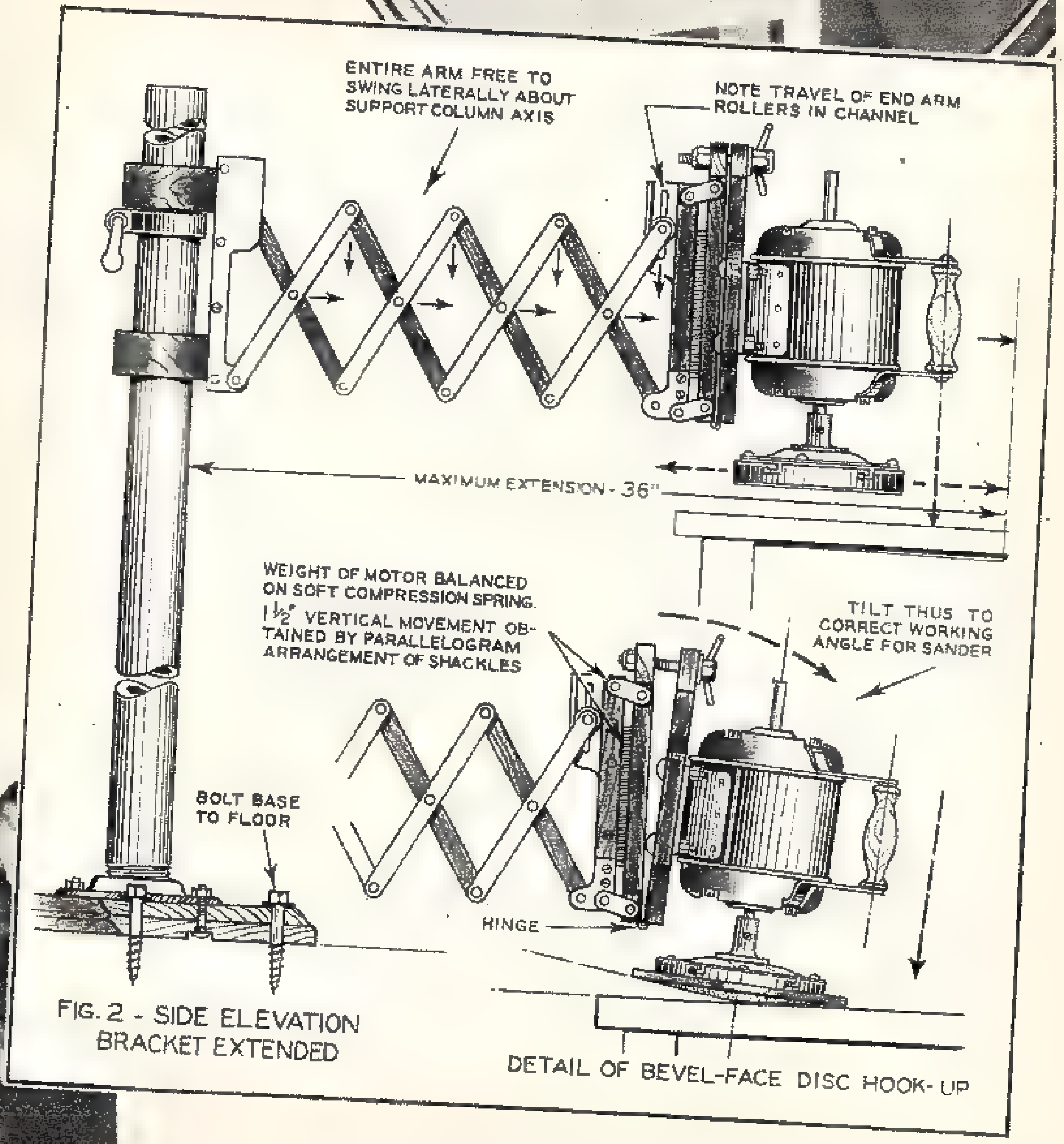
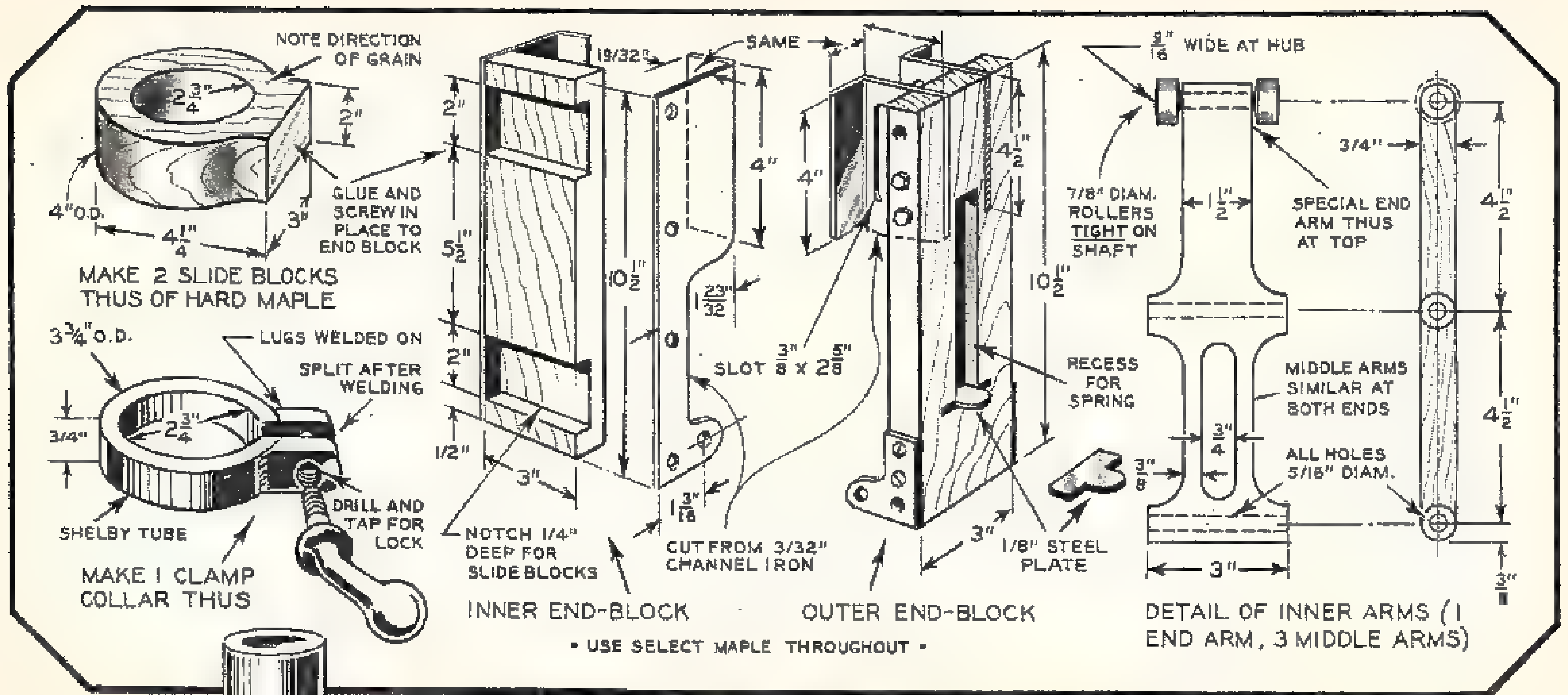

ENTIRE ARM FREE TO SWING LATERALLY ABOUT SUPPORT COLUMN AXIS
NOTE TRAVEL OF END ARM ROLLERS IN CHANNEL
MAXIMUM EXTENSION - 36″
WEIGHT OF MOTOR BALANCED ON SOFT COMPRESSION SPRING.
1½″ VERTICAL MOVEMENT OBTAINED BY PARALLELOGRAM ARRANGEMENT OF SHACKLES
TILT THUS TO CORRECT WORKING ANGLE FOR SANDER
BOLT BASE TO FLOOR
HINGE

FIG. 2 - SIDE ELEVATION BRACKET EXTENDED

DETAIL OF BEVEL-FACE DISC HOOK-UP


NOTE DIRECTION OF GRAIN
2¾"
2"
GLUE AND SCREW IN PLACE TO END BLOCK
4" O.D.
4¼"
3"
MAKE 2 SLIDE BLOCKS THUS OF HARD MAPLE
3¾" O.D.
LUGS WELDED ON
SPLIT AFTER WELDING
3/4"
2¾"
SHELBY TUBE
DRILL AND TAP FOR LOCK
MAKE 1 CLAMP COLLAR THUS
19/32"
SAME
2"
5½"
2"
1/2"
3"
10½"
4"
1 23/32"
SLOT 3/8 x 2 5/8"
1 3/16"
NOTCH 1/4" DEEP FOR SLIDE BLOCKS
CUT FROM 3/32" CHANNEL IRON
INNER END-BLOCK
4"
4½"
10½"
RECESS FOR SPRING
3"
1/8" STEEL PLATE
OUTER END-BLOCK
• USE SELECT MAPLE THROUGHOUT •
9/16" WIDE AT HUB
7/8" DIAM. ROLLERS TIGHT ON SHAFT
1½"
SPECIAL END ARM THUS AT TOP
3/4"
4½"
MIDDLE ARMS SIMILAR AT BOTH ENDS
3/4"
3/8"
ALL HOLES 5/16" DIAM.
4½"
3"
3/8"
DETAIL OF INNER ARMS (1 END ARM, 3 MIDDLE ARMS)

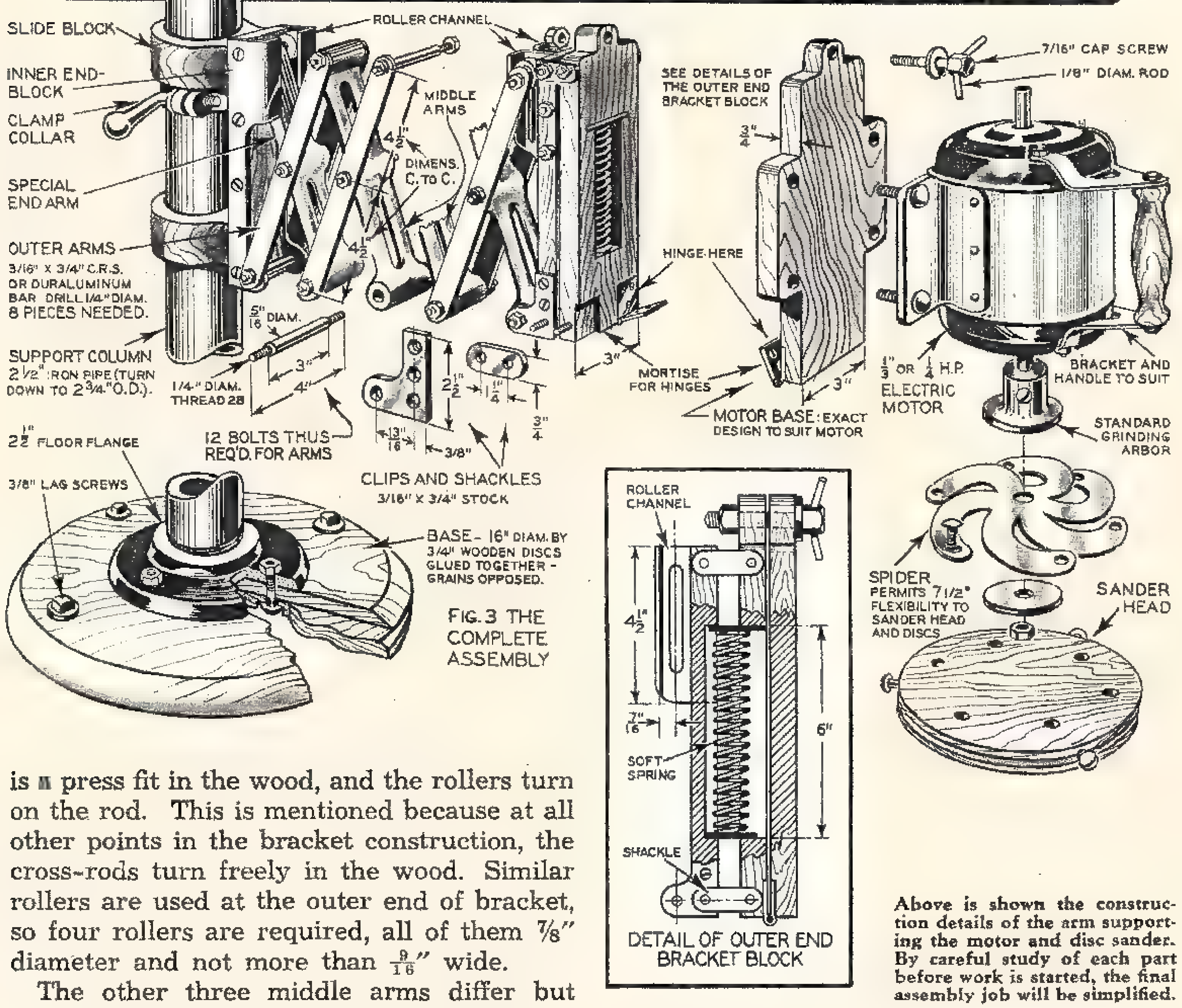

SLIDE BLOCK
ROLLER CHANNEL
INNER END-BLOCK
CLAMP COLLAR
MIDDLE ARMS
SPECIAL END ARM
4½"
DIMENS. C. TO C.
4½"
OUTER ARMS
3/16" X 3/4" C.R.S. OR DURALUMINUM BAR DRILL 1/4" DIAM. 8 PIECES NEEDED.
SUPPORT COLUMN 2½" IRON PIPE (TURN DOWN TO 2¾" O.D.).
5/16" DIAM.
1/4" DIAM. THREAD 28
4"
2½"
1¼"
3/4"
13/16"
3/8"
12 BOLTS THUS REQ'D. FOR ARMS
CLIPS AND SHACKLES 3/16" X 3/4" STOCK
2½" FLOOR FLANGE
3/8" LAG SCREWS
BASE - 16" DIAM. BY 3/4" WOODEN DISCS GLUED TOGETHER - GRAINS OPPOSED.
SEE DETAILS OF THE OUTER END BRACKET BLOCK
3/4"
HINGE HERE
3"
MORTISE FOR HINGES
3"
MOTOR BASE: EXACT DESIGN TO SUIT MOTOR
7/16" CAP SCREW
1/8" DIAM. ROD
1/3 OR 1/4 H.P. ELECTRIC MOTOR
BRACKET AND HANDLE TO SUIT
STANDARD GRINDING ARBOR
SPIDER PERMITS 7 1/2° FLEXIBILITY TO SANDER HEAD AND DISCS
SANDER HEAD
ROLLER CHANNEL
4½"
7/16"
SOFT SPRING
6"
SHACKLE
DETAIL OF OUTER END BRACKET BLOCK

FIG. 3 THE COMPLETE ASSEMBLY

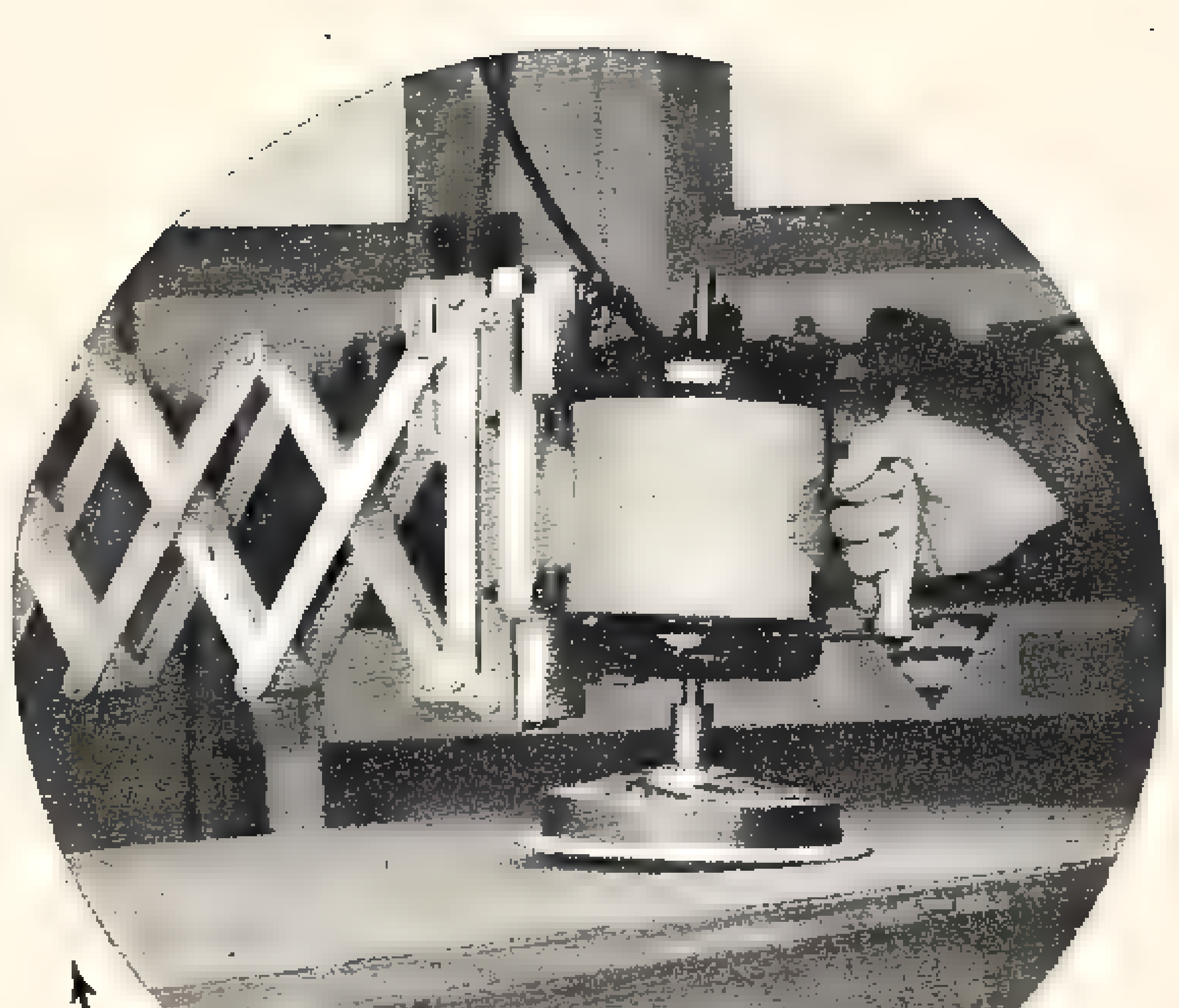
Above is shown the construction details of the arm supporting the motor and disc sander. By careful study of each part before work is started, the final assembly job will be simplified.

is a press fit in the wood, and the rollers turn on the rod. This is mentioned because at all other points in the bracket construction, the cross-rods turn freely in the wood. Similar rollers are used at the outer end of bracket, so four rollers are required, all of them ⅞" diameter and not more than $\frac{9}{16}$" wide.

The other three middle arms differ but slightly. The pattern can readily be cut out on a scroll saw. Care must be taken in boring the holes. If these are inaccurately spaced, or not exactly parallel, it will cause binding in the operation of the bracket. A reasonably accurate jig can be made of hard maple, which will serve in boring the metal arms as well as the maple arms.

Eight outer arms are required. If $\frac{3}{16}$"x¾" dural bar is readily available, its use is recommended. Otherwise use cold rolled steel. It is well to refer at this point to the outer end roller shaft.

Fig. 3 presents the plan cross-section of the bracket block, outer end. Again $\frac{3}{32}$"x1¾"x1¾" angle iron serves as a channel for the rollers. The outer block is really a composite of three blocks held together with shackles and hinges, so that the motor has a limited vertical and tilting movement. By checking each individual part against the complete assembly, the construction will be obvious.



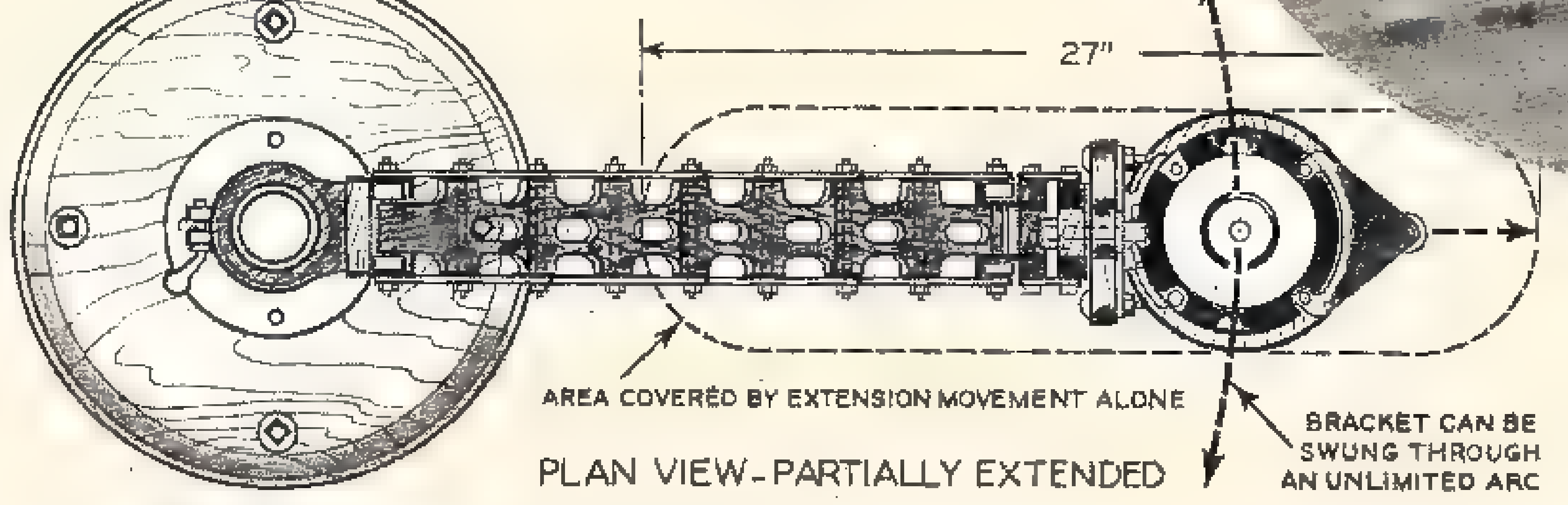

27"
AREA COVERED BY EXTENSION MOVEMENT ALONE
BRACKET CAN BE SWUNG THROUGH AN UNLIMITED ARC

FIG. 4

PLAN VIEW-PARTIALLY EXTENDED

Above is shown the sander in operation. At left is a plan view of the arm partially extended. Below are construction details of the sander disc.

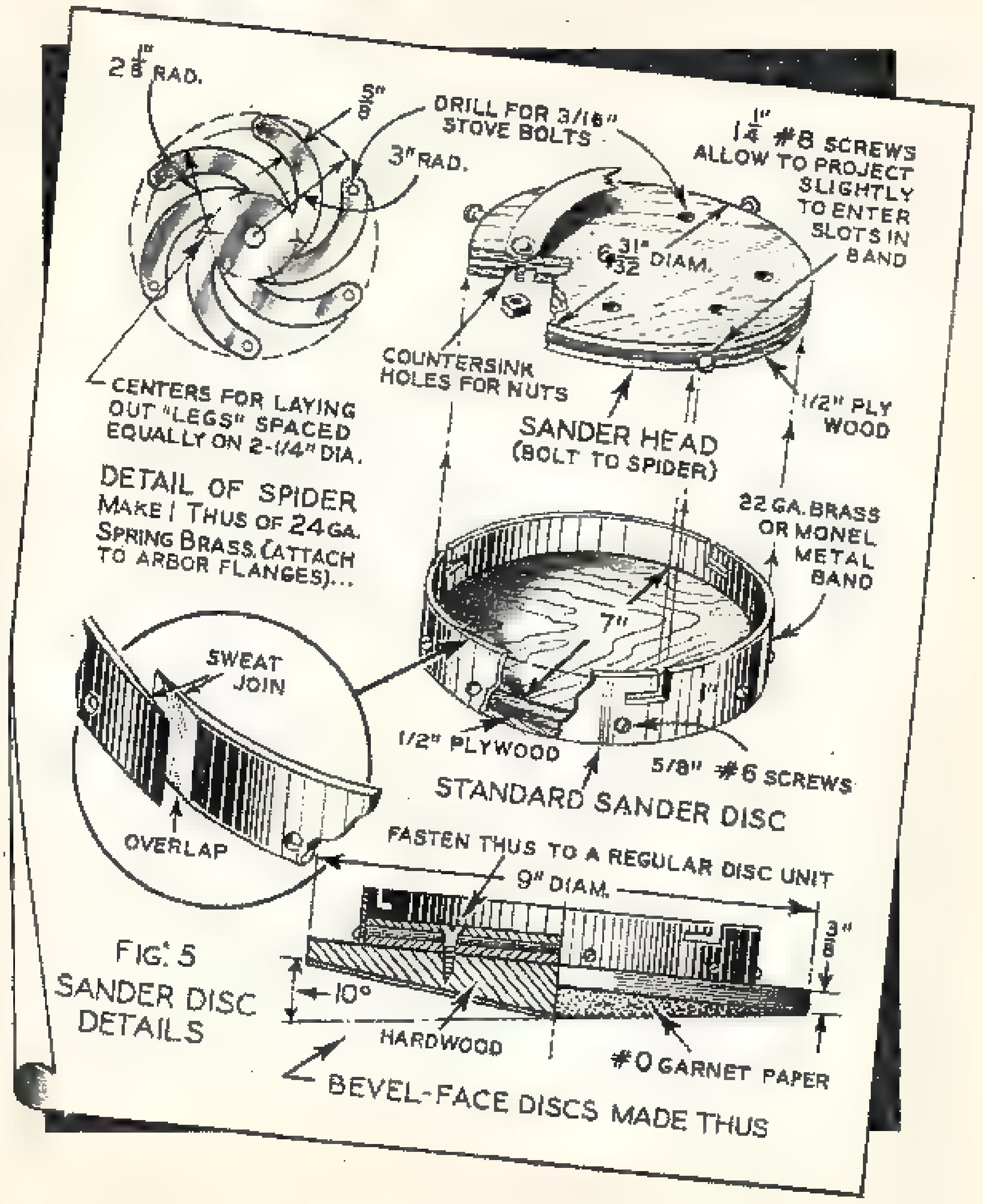

2⅛" RAD.
5/8"
DRILL FOR 3/16" STOVE BOLTS
3" RAD.
1¼" #8 SCREWS ALLOW TO PROJECT SLIGHTLY TO ENTER SLOTS IN BAND
6 31/32" DIAM.
COUNTERSINK HOLES FOR NUTS
CENTERS FOR LAYING OUT "LEGS" SPACED EQUALLY ON 2-1/4" DIA.
SANDER HEAD (BOLT TO SPIDER)
1/2" PLY WOOD
DETAIL OF SPIDER MAKE 1 THUS OF 24 GA. SPRING BRASS. (ATTACH TO ARBOR FLANGES)...
22 GA. BRASS OR MONEL METAL BAND
7"
1"
SWEAT JOIN
1/2" PLYWOOD
5/8" #6 SCREWS
STANDARD SANDER DISC
OVERLAP
FASTEN THUS TO A REGULAR DISC UNIT
9" DIAM.
3/8"
10°
HARDWOOD
#0 GARNET PAPER
BEVEL-FACE DISCS MADE THUS

FIG. 5 SANDER DISC DETAILS

Novelty and practicability are incorporated into the sanding disk assembly shown in Fig. 3. The attachment to the motor shaft is made with a standard arbor. The spring brass "spider" is held between the flanges of the arbor and the ends of the "legs" are bolted to the sander head. The sanding disks proper are made of ½" plyboard with a 1" metal band around the circumference. Twenty-two gauge brass or monel metal is recommended for the bands, but galvanized iron can be used. The sanding disks attach to the head disk with bayonet type fasteners. Obviously, the bevel-face disk is merely a modification of the regular disks. It is well to make about three regular disks and fit them with a variety of sand-paper.

Any motor capable of withstanding nominal end thrust can be used with this tool. A ⅓ h. p., 3400 r. p. m. motor is especially recommended for this tool, but a ¼ h. p. or ⅓ h. p., 1750 r. p. m. motor will serve satisfactorily.

The small cost involved in building this useful tool should commend it to every home workshop fan. It will save hours of time and plenty of "elbow grease" when large surfaces must be smoothed.

Those who have had to sand down a table top, particularly a large one, know that considerable effort was necessary before the desired result was obtained. With this tool, all the work is done by the motor, the operator merely moving it over the area to be smoothed. If a coat of enamel is applied to the tool, the finished job will not only be useful, but will present an attractive appearance.

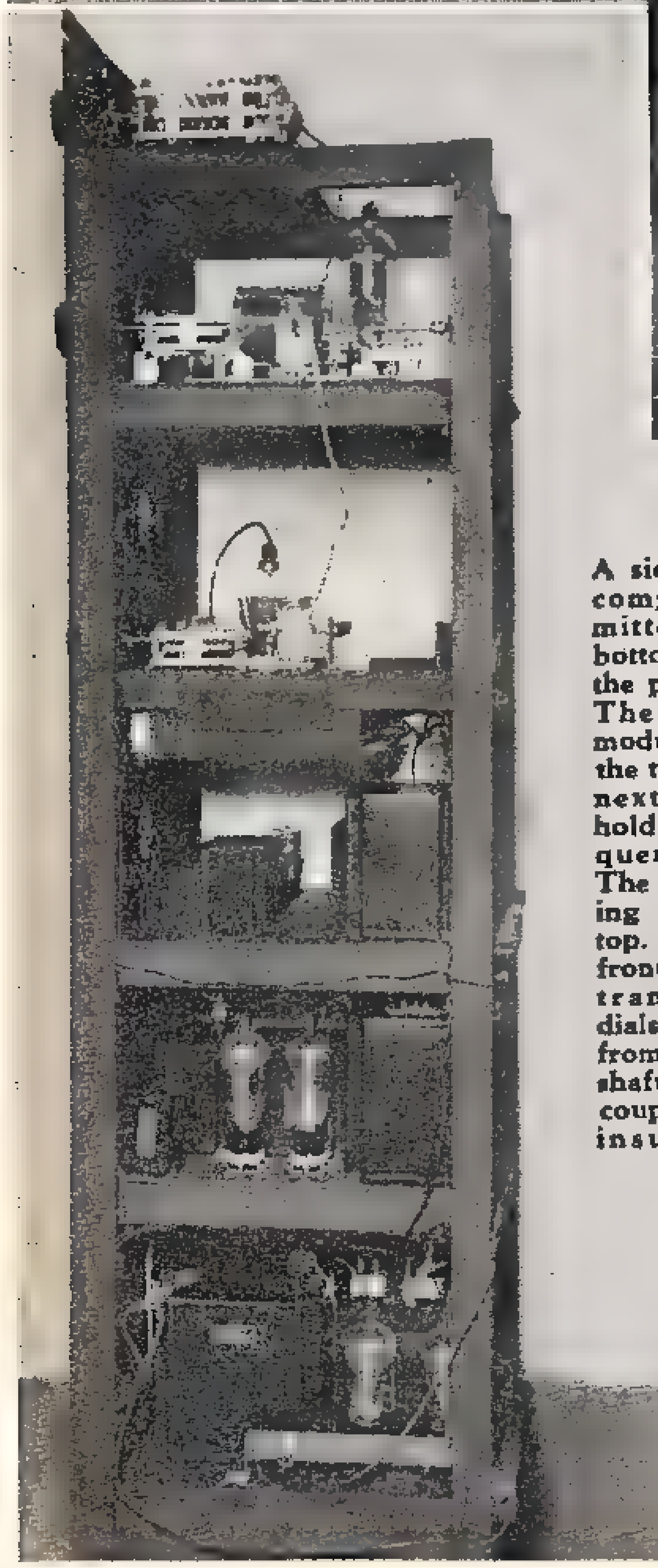
As shown in the photograph, the sander can be attached to a drill press column without disturbing the drill. This is particularly helpful when extra space is not available in the workshop. When the sander is not in use, it will take up very little room.

The MM Short-Wave TRANSMITTER

PART III

by

Clifford Peters



A side view of the completed transmitter. The two bottom shelves hold the power supplies. The driver and modulator are on the third shelf. The next two shelves hold the radio frequency section. The antenna tuning unit is at the top. Above is a front view of the transmitter. All dials are insulated from the condenser shafts by flexible couplings and short insulator rods.

ALMOST every amateur at some time finds himself with a desire to go on phone. Those who constructed the transmitter described in the February and March issues will find this modulator and speech amplifier ideally suited to the rig.

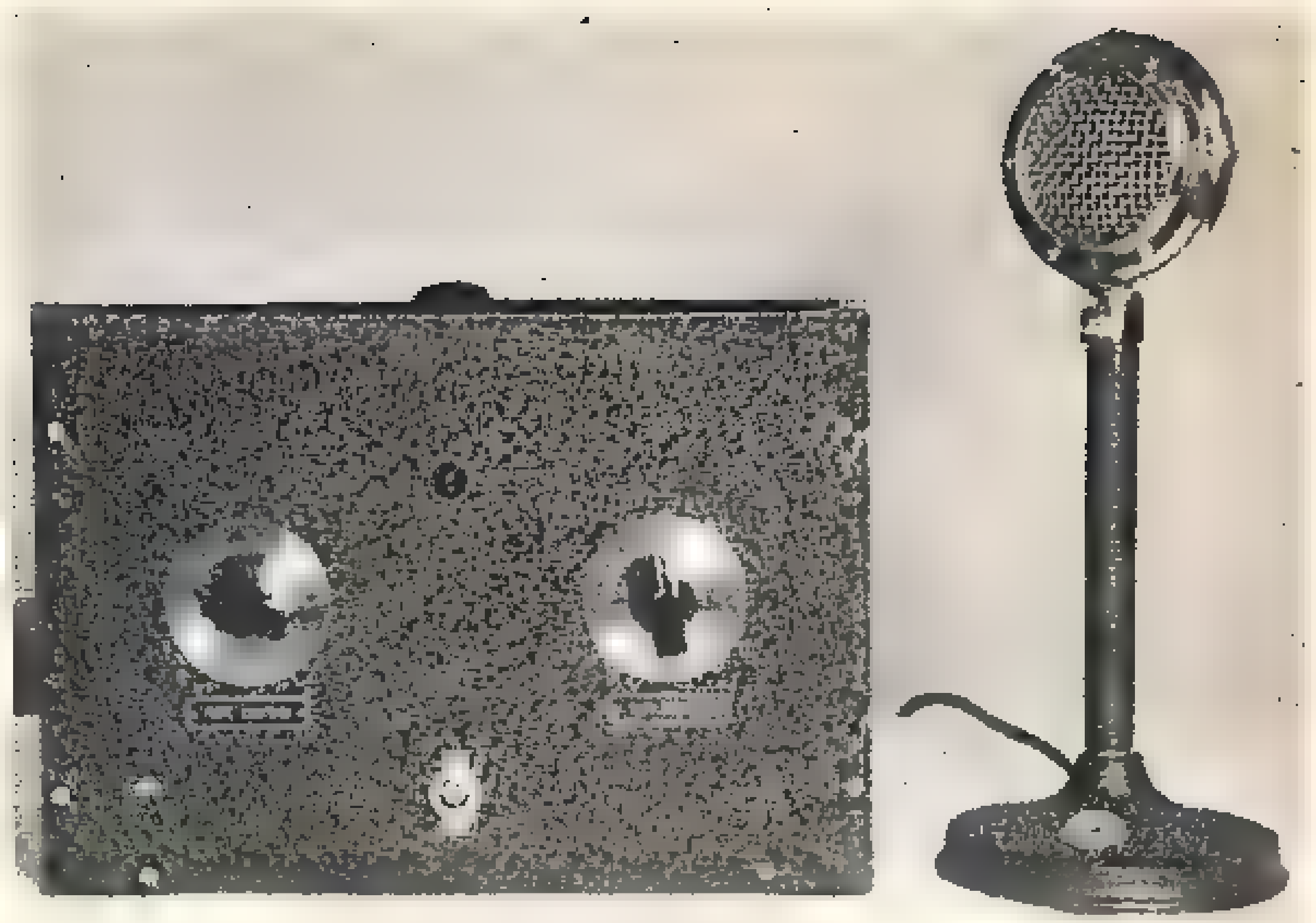
The tube line up shown will permit the modulator to "loaf along" and still give 100 per cent, or the more correct 95 per cent, modulation. With no need for working the equipment up to its limit, the quality will be excellent, with a minimum of troubles to clear up.

Two power supplies were used; one for the speech amplifier and driver, and one for the modulator. The small supply should deliver 400 volts to the drivers, with approximately 275 volts for the speech amplifier. This can be obtained either by tapping off the bleeder, or by a dropping resistor.

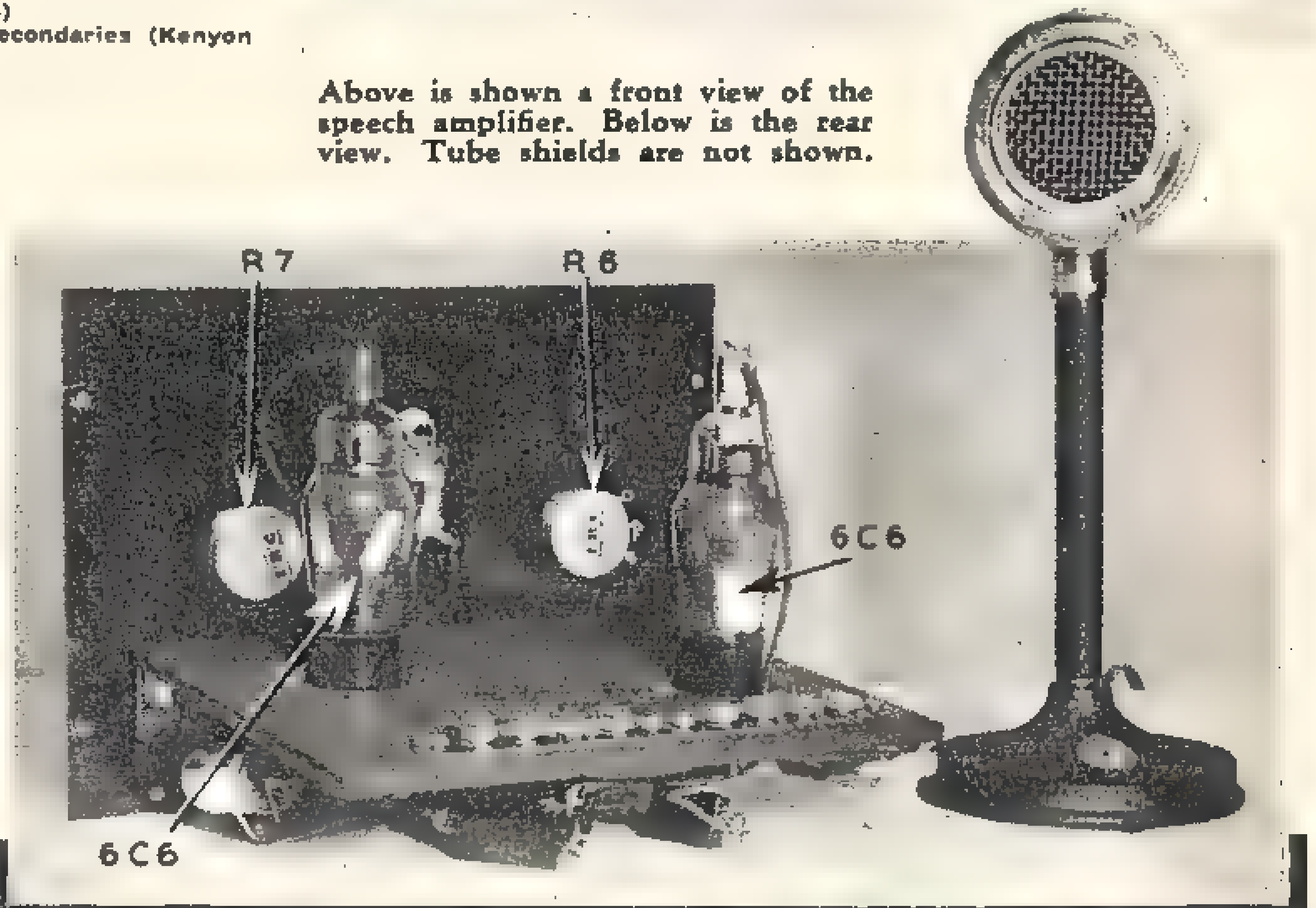
The modulator was laid out to give plenty of room between parts. The filament trans-

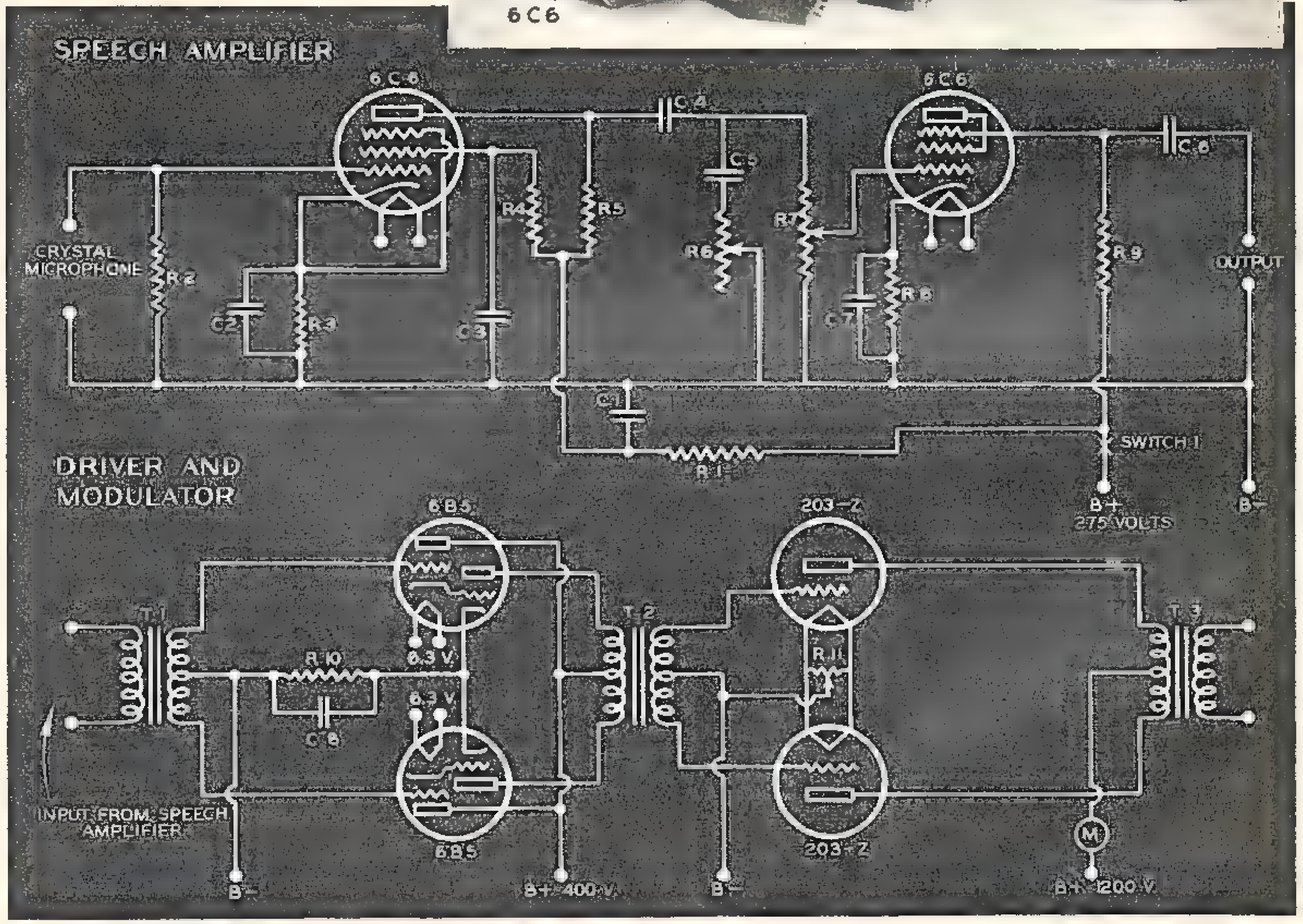
PARTS REQUIRED

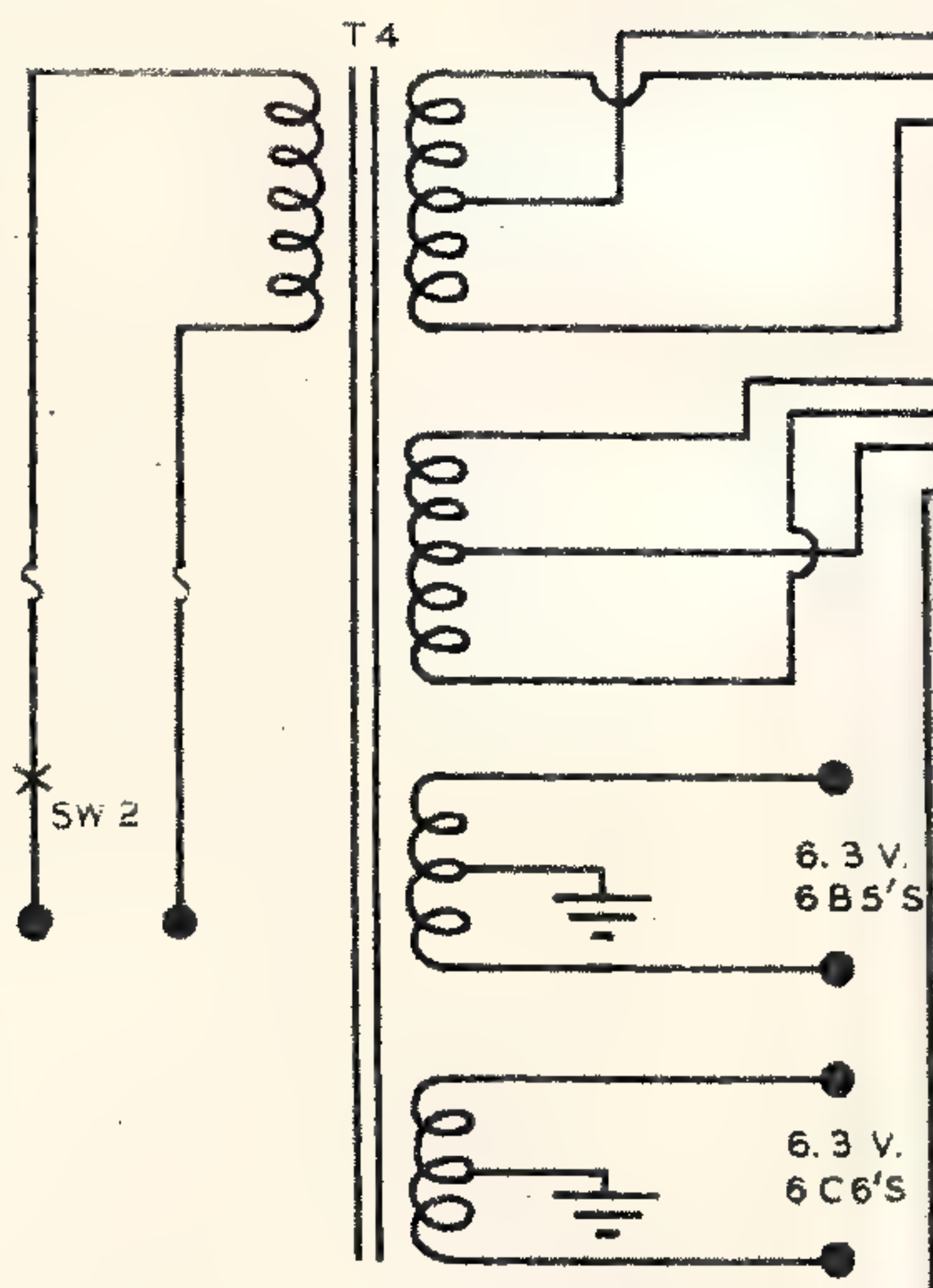
R1 50,000 ohms (IRC BT-2)
R2 4 megohms (IRC BT-2)
R3 1,000 ohms (IRC BT-2)
R4 2 megohms (IRC B-2)
R5 500,000 ohms (IRC BT-2)
R6 500,000 ohms ton control (IRC 11-133)
R7 500,000 ohms volume control (IRC 11-133)
R8 1,000 ohms (IRC BT-2)
R9 100,000 ohms (IRC BT-2)
R10 150 ohms (IRC BT-2)
R11 60 ohms center tap (IRC M-832)
R12 40,000 ohms (IRC EPA)
R13 100,000 ohms (IRC HOA)
C1 .5 mf. (receiving type)
C2 25 mf. 50-volt working (Aerovox)
C3 .1 mf. receiving type
C4 .02 mf. (Aerovox receiving type)
C5 .005 mf. (Solar receiving type)
C6 .1 mf. receiving type
C7 25 mf. 50-volt working (Aerovox)
C8 25 mf. 50-volt working (Aerovox)
C9 2 mf. 1,000-volt working Cornell-Dubilier TJ-10020)
C10 2 mf. 1,000-volt working (Cornell-Dubilier TJ-10020)
C11 2 mf. 2,000-volt working
C12 2 mf. 2,000-volt working
T1 Driver input transformer (Kenyon T-52)
T2 Driver transformer (Kenyon T-263)
T3 Class "B" output transformer (Kenyon T-465)
T4 425-0-425-volt, 6.3 volt, 6.3 volt, 5-volt secondaries (Kenyon T-244)
T5 1460-0-1460-volt (Kenyon T-666)
T6 2.5-volt, 10 ampere, (Kenyon T-360)
T7 10-volt, 8-ampere (Kenyon T-361)
Ch1 Filter choke (Kenyon T-154)
Ch2 5-18 henry swinging choke (Kenyon T-513)
Ch3 10 henry filter choke (Kenyon T-176)
Crystal microphone (Shure Brothers 70-S)
Four 6-prong sockets (Hammarlund S-6)
Two 4-prong sockets (Hammarlund S-4)
Two sockets for 203-Z's (ICA No. 956)
Sw1, Sw2, Sw3, Sw4, s. p. s. t. (ICA No. 1230)
Terminal strips, three 4-terminal (ICA No. 2413)
two 2-terminal (ICA No. 2420)
one 6-terminal (ICA No. 2404)
Fuse mounting (ICA No. 2342)
Metal cabinet (ICA No. 3826)
Tubes: two Taylor 203Z
two Taylor 866
two 6B5 (Raytheon)
two 6C6 (Raytheon)
Milliammeter 0-300 (Triplett)
Grid caps (ICA No. 870)
Name plates (ICA)
Dials (ICA No. 2169)
Pointer knobs and dial plates (ICA No. 2240. 2241)



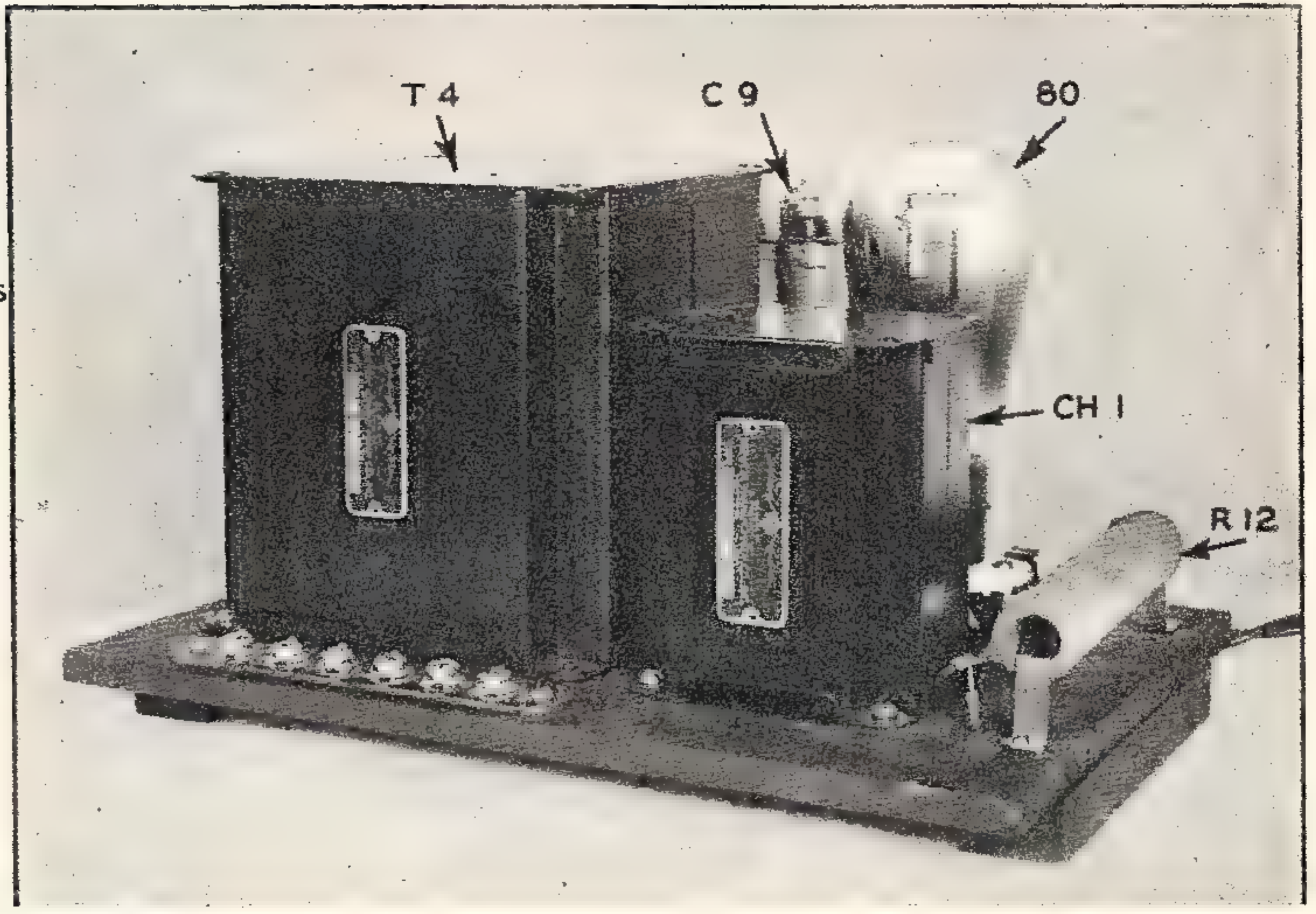
Above is shown a front view of the speech amplifier. Below is the rear view. Tube shields are not shown.



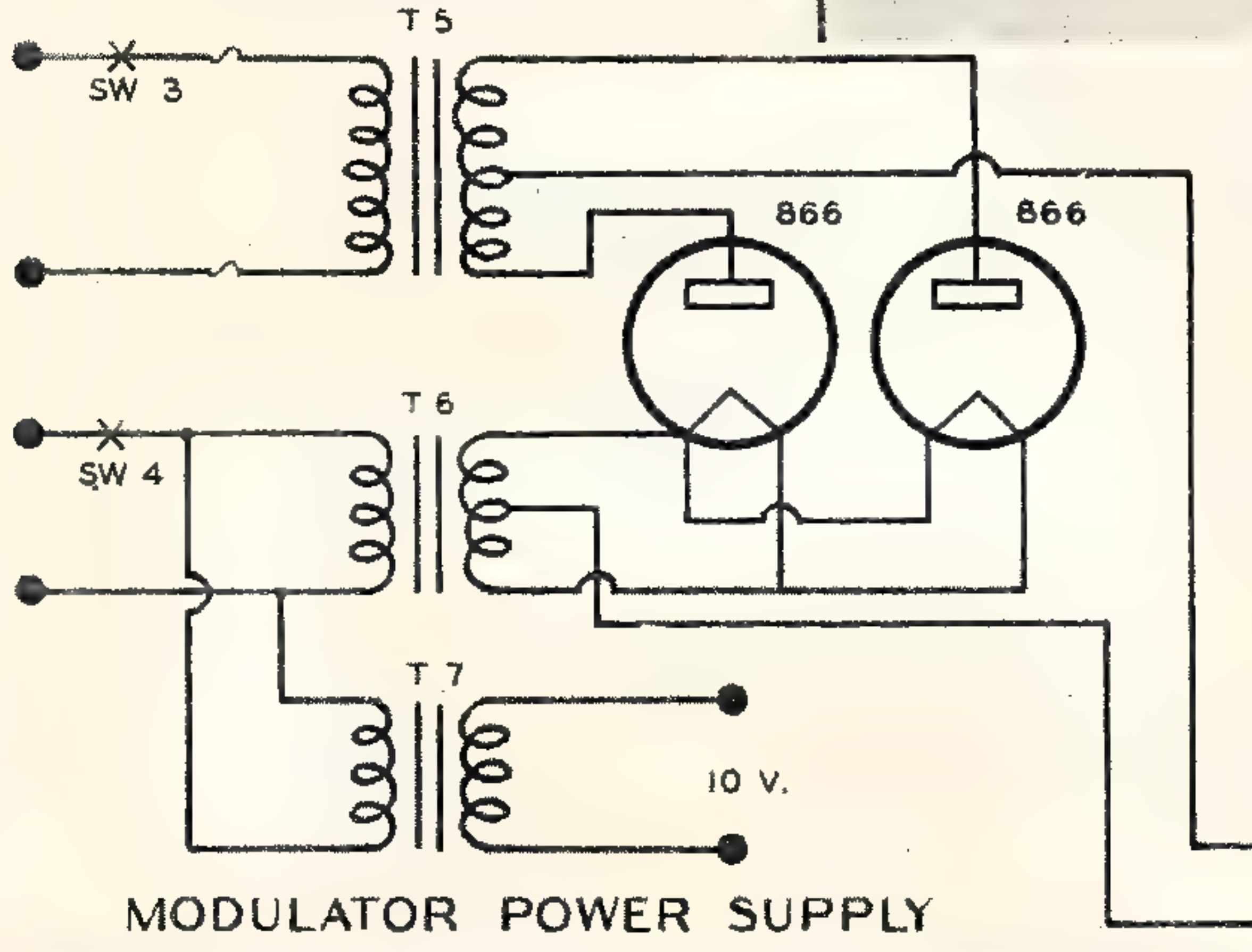




POWER SUPPLY FOR DRIVERS AND SPEECH AMPLIFIER



At right is the power supply for the speech amplifier and drivers. T4 supplies filament power for 6C6's and 6B5's.



MODULATOR POWER SUPPLY

former for the 203Z's as shown in the photographs, is mounted at the rear of the baseboard. Inasmuch as almost eight amperes is consumed by the filaments of these tubes, the wire used for connections should be fairly heavy, at least No. 14. Leads also should be as short as possible to prevent voltage drop.

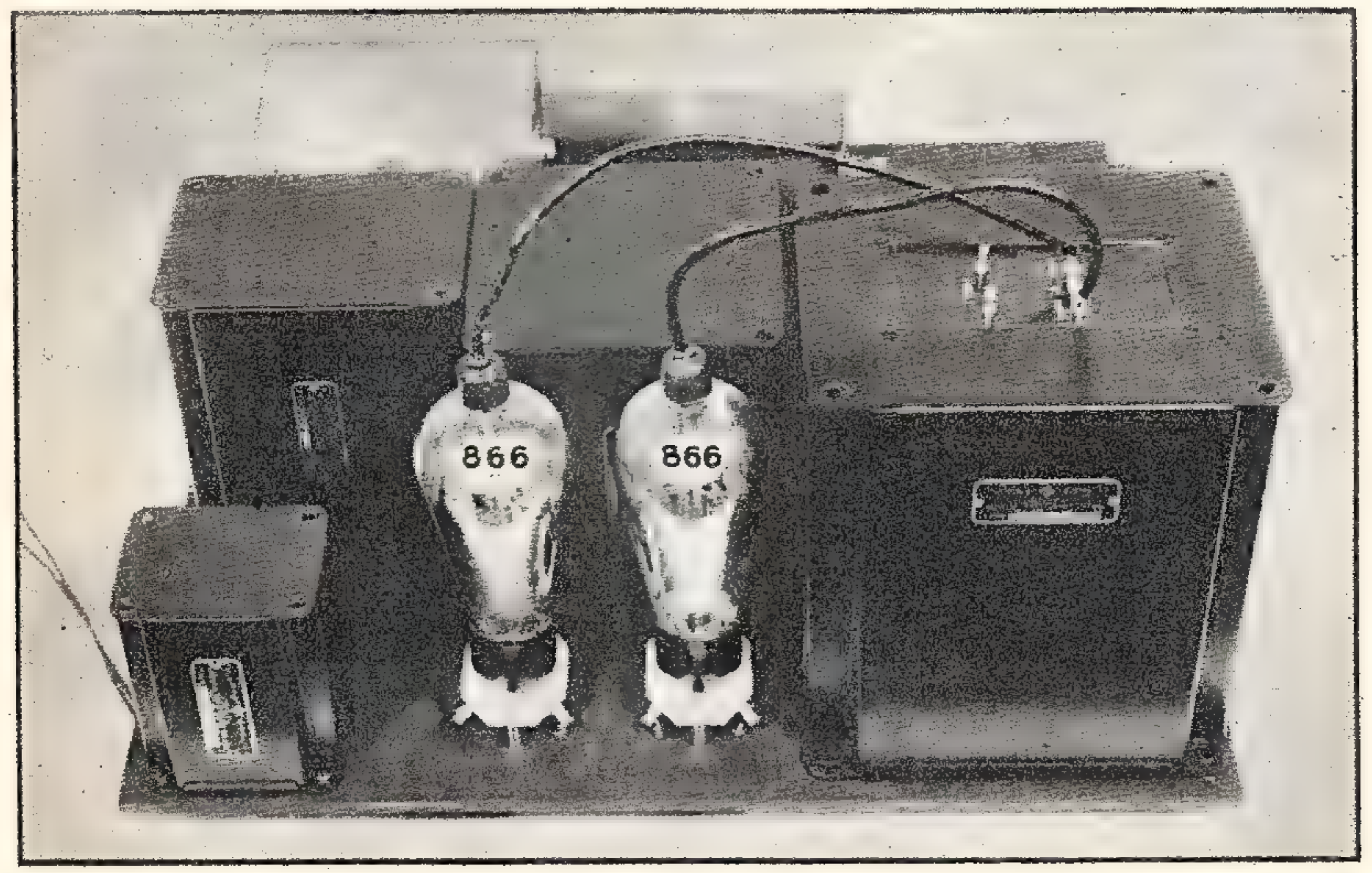
The speech amplifier was constructed as a separate unit to prevent pickup and resultant feedback. Shielded cable should be used for connecting it to the driver tubes. Beside the electrical advantage of having the speech amplifier separated from the rest of the transmitter, the operator will find it convenient to have it on the operating table, for easy adjustment of the gain control and the tone control.

When the gain is turned up high, the tone control will be very useful for cutting out background noises and unnecessary pickup.

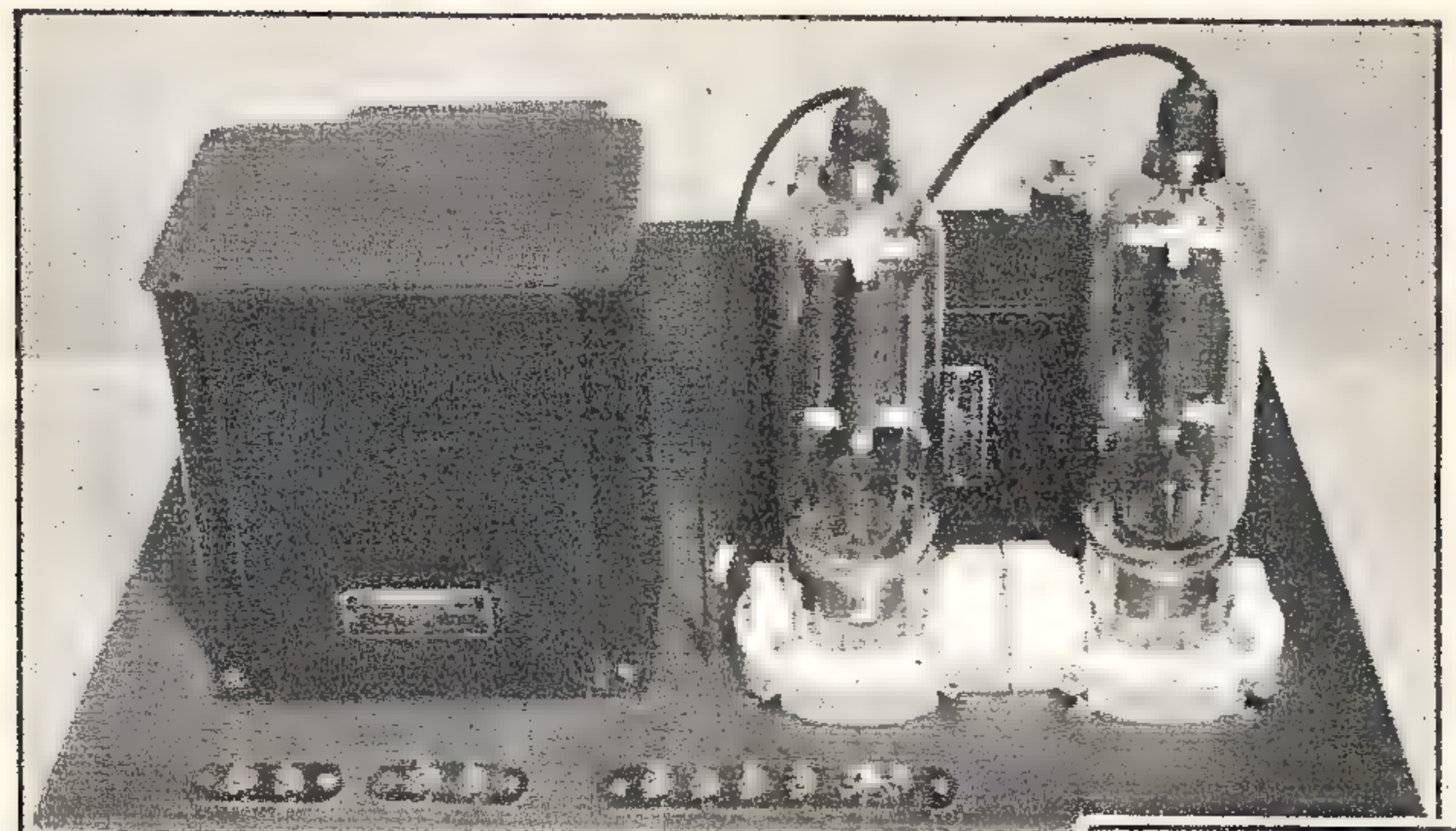
The construction details of both the speech amplifier and modulator are simple and little can be said to help the individual builder. The pilot light on the speech amplifier panel is connected in the filament circuit of the 6C6 tubes. If this circuit is connected into the line feeding the rest of the transmitter, it will serve as continual notification that the rig is "alive." When the audio equipment is completed and ready for tests, do not apply power and speak into the microphone unless the modulation transformer has a load applied to it. This can be in the form of a bleeder connected across the terminals and a loudspeaker connected across a very small portion of the resistance.

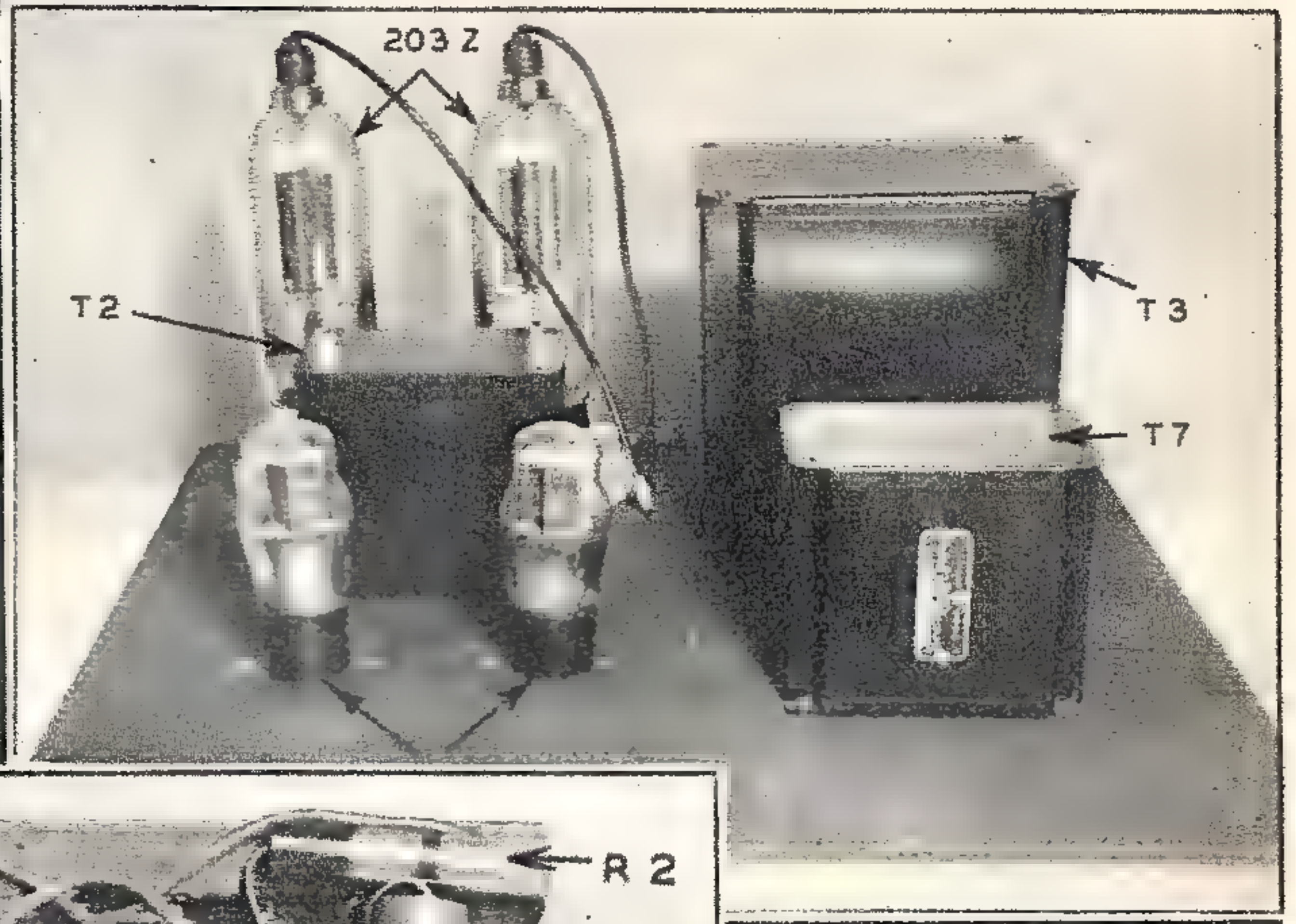
The builder then can test for

[*Continued on page* 118]

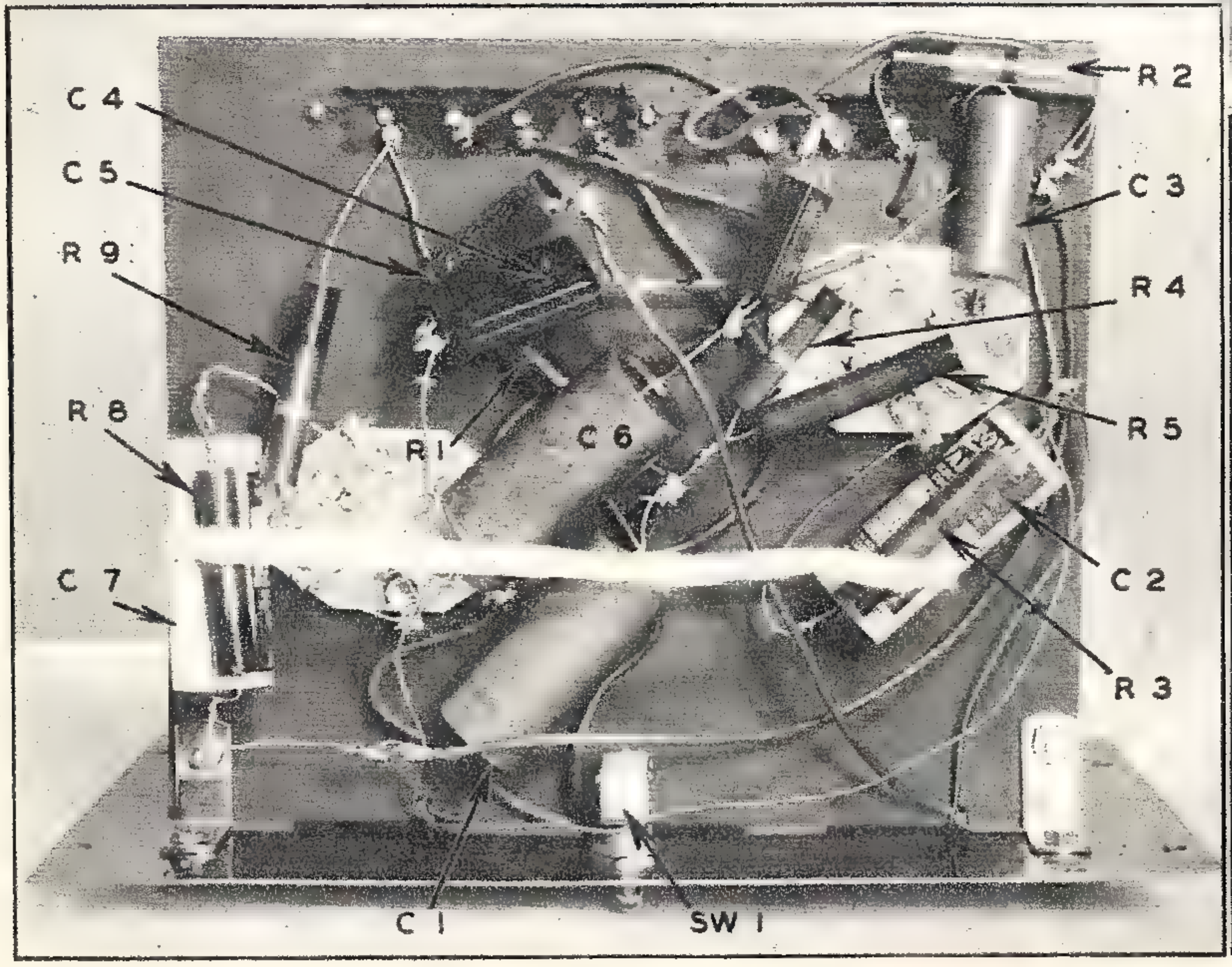


At left is the power supply for the 203Z modulator tubes. Ch2, the swinging choke, is next to the plate transformer. The bleeder should be adjustable so that plate voltage can be reduced when desired.



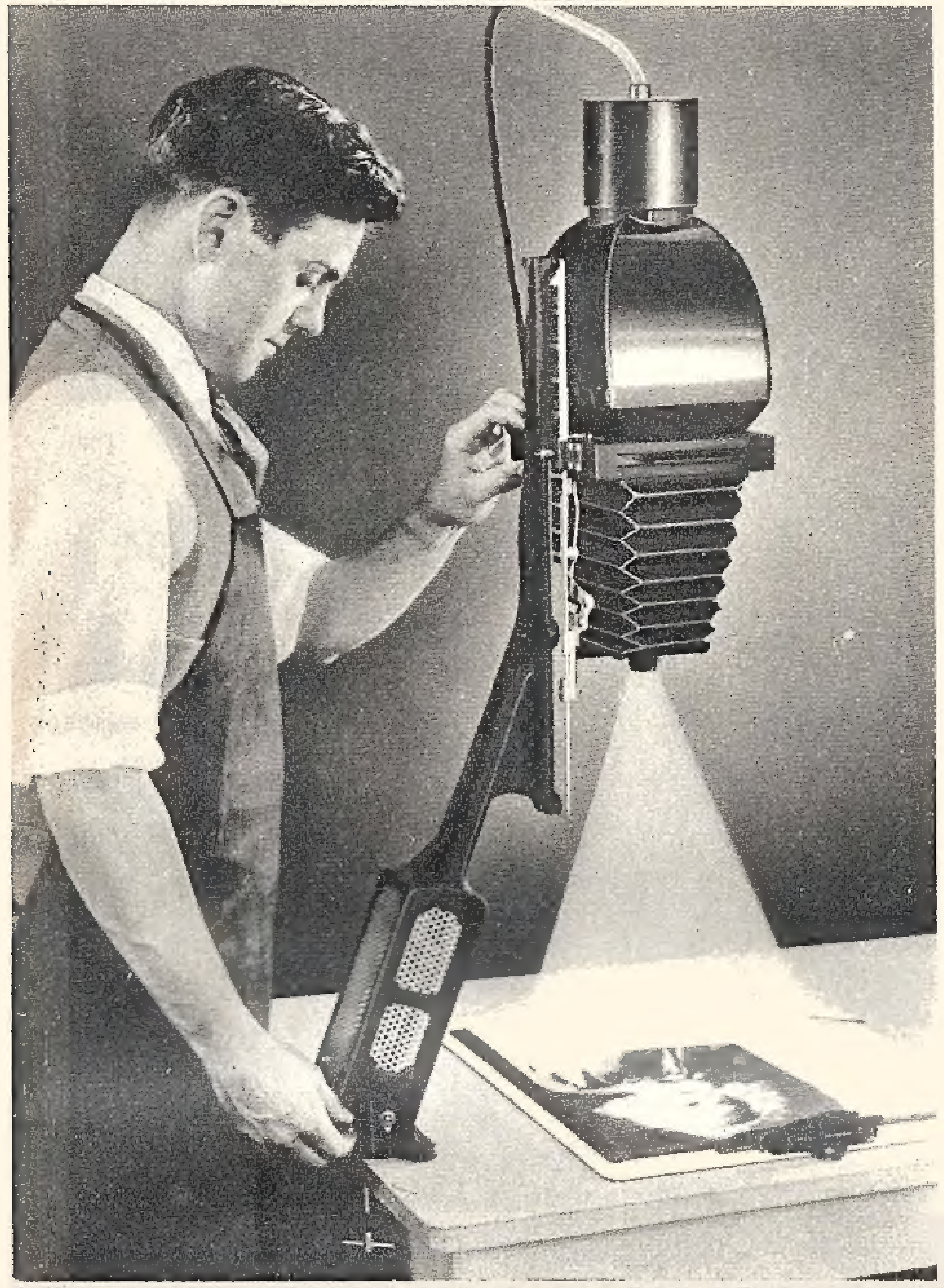


Above is the rear view of the modulator showing the 203Z's and the modulation and driver transformers. When testing, be sure that a load is connected to the output of this stage before speaking into the microphone. At the right is another view showing the 6B5's just behind the driver transformer. T7 supplies power for the 203Z filaments.



An under view of the speech amplifier. A metal panel and cabinet are used to insure adequate shielding. The lead from the amplifier to the driver stage should be of the shielded type. By connecting pair of phones to output connections, this section can be tested for quality before connecting it to the driver stage.

How To Make Enlargements



A typical "auto-focus" enlarger taking negatives up to 4x6 inches. It is readily clamped to the edge of a shelf or table in the dark room. This is a good instrument for the beginner because the automatic focusing action makes it practically foolproof.

CONTRARY to general impression, it is no more difficult to make enlargements than contact prints. Enlarging offers many advantages besides big pictures; you can mask off unimportant parts of the negative and thus give emphasis to the better sections, and also perform all sorts of dodging operations. Many books have been written on the subject, but the fundamentals can be explained in a short article.

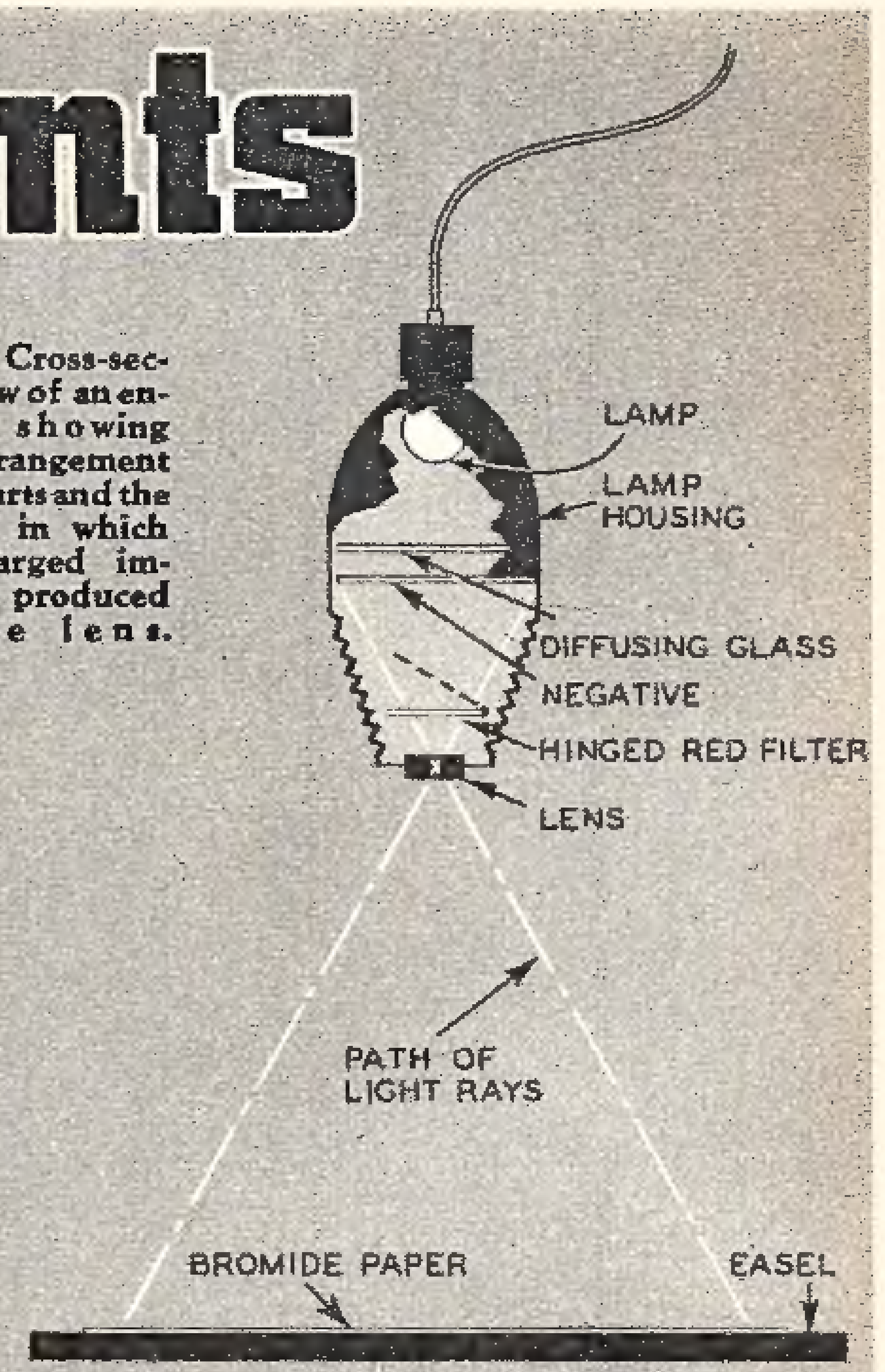
An "enlarger" is nothing more than a camera turned upside down, with light from a strong bulb made to shine through the negative, through a lens, and then onto a sheet of photographic paper of the desired size. Figure 1 represents the internal construction of 95% of the enlargers in use today. Some enlargers made for small negatives (the 35 millimeter size used in "candid" cameras) have one or more condensing lens placed between the bulb and the negative, to concentrate the light. The only real mechanical differences that will be found between various enlargers is that some are "auto focus" and others aren't. In the former type, a cam device moves the lens closer to the negative as the whole enlarger head is raised to make bigger prints; in the latter, this adjustment must be made by hand as the operator judges the sharpness of the image projected on the enlarger easel. The self-focusing type of course is more convenient, but then it costs more.

Most present day enlargers are of vertical construction, the lamp housing, with its attached negative holder and lens, being mounted on a heavy pipe or other standard. However, horizontal arrangements work just as well and some people prefer them. Their bad feature is the large amount of table space they occupy. The accompanying pictures show representative enlargers of popular styles.

The dark room set-up for enlarging is very much like the one shown on page 108 of the December, 1937 issue of MODERN MECHANIX, modified as in Figure 2. As most amateurs rarely make prints larger than 8x10 inches, three trays of this size should be used. The first contains developer, the second the acetic acid shortstop bath (1½ ounces of acetic acid and cold water to make a quart), and the third the regular hypo fixing bath. The tank in the back is filled with water for washing the print tongs. The safelight is fitted with an OA (bright yellow) filter as recommended in the December article.

The most successful and widely used paper developer undoubtedly is "D-72," which is available in prepared dry form, requiring only mixing with water. The "stock solution" is diluted 1:4 for enlarging paper, so a single can will last quite a while. An 8x10 tray will require at least a quart of solution; so measure out 6¼ ounces of stock solution and add cold water (70 degrees is the ideal temperature) to make 32 ounces. It is not advisable or economical to save this stuff after use. If it looks brownish, throw it away and mix a fresh bottle-full. The chemicals are cheaper than wasted prints and wasted time. By the way, don't fail to filter the solution before use.

Cleanliness and absolute freedom from dust in the dark room are the real secrets of enlarging success. One writer says that almost surgical cleanliness is necessary, and he isn't exaggerating much. A tiny speck of dust or lint on the negative looks like a baseball on the print with even medium size blow-ups. Clean the negative holder glasses (if a glass sandwich is used) by breathing gently on them and wiping again very gently, with a soft cloth. If you rub too hard you will electrify the glass and make it attract infinitesimal dust



Fix. 1: Cross-section view of an enlarger, showing the arrangement of the parts and the manner in which an enlarged image is produced by the lens.

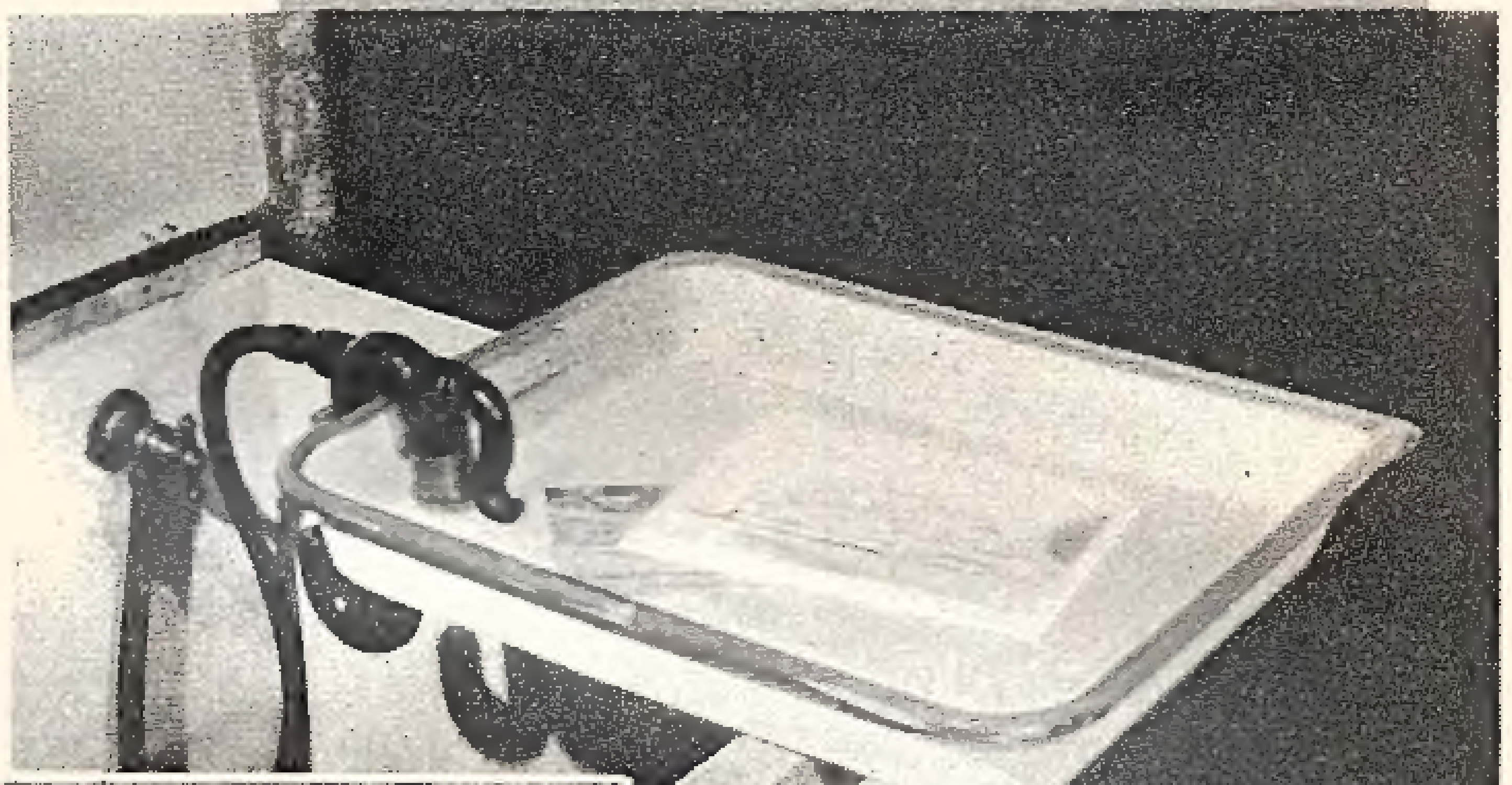


Fig. 3, above: A simple siphon attachment converts an ordinary tray into a very effective print washer. The tray is placed on the edge of a washtub or sink.

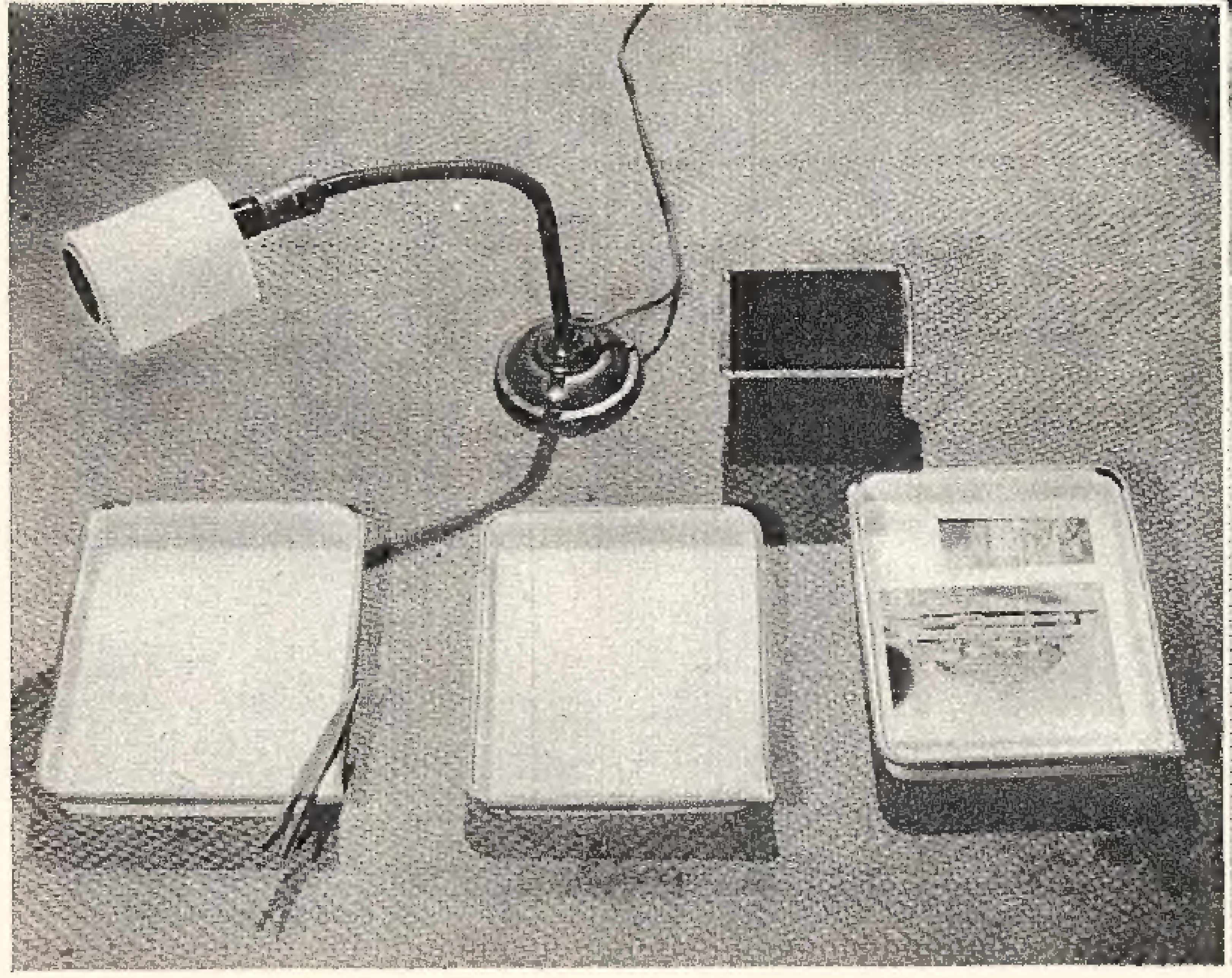
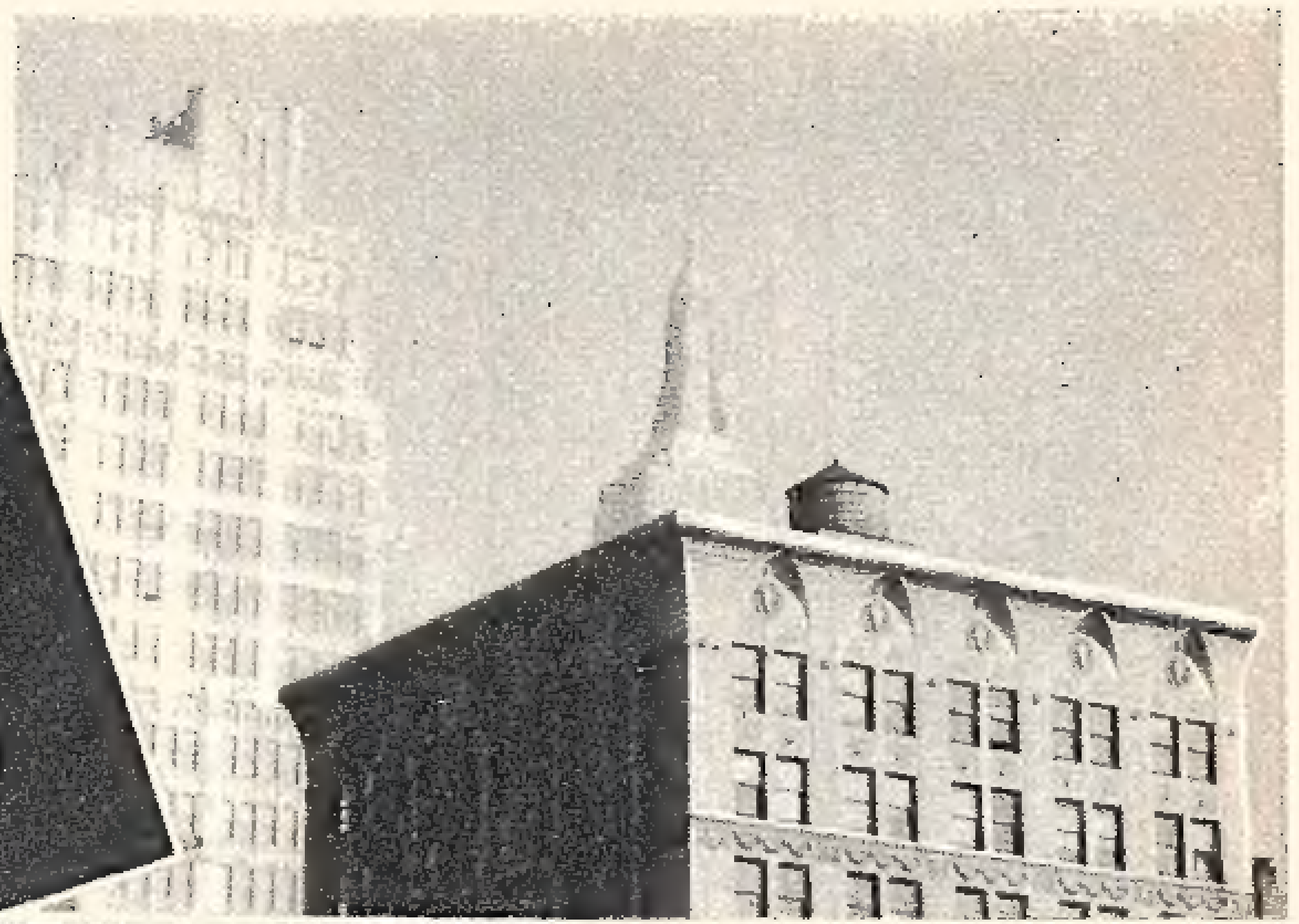


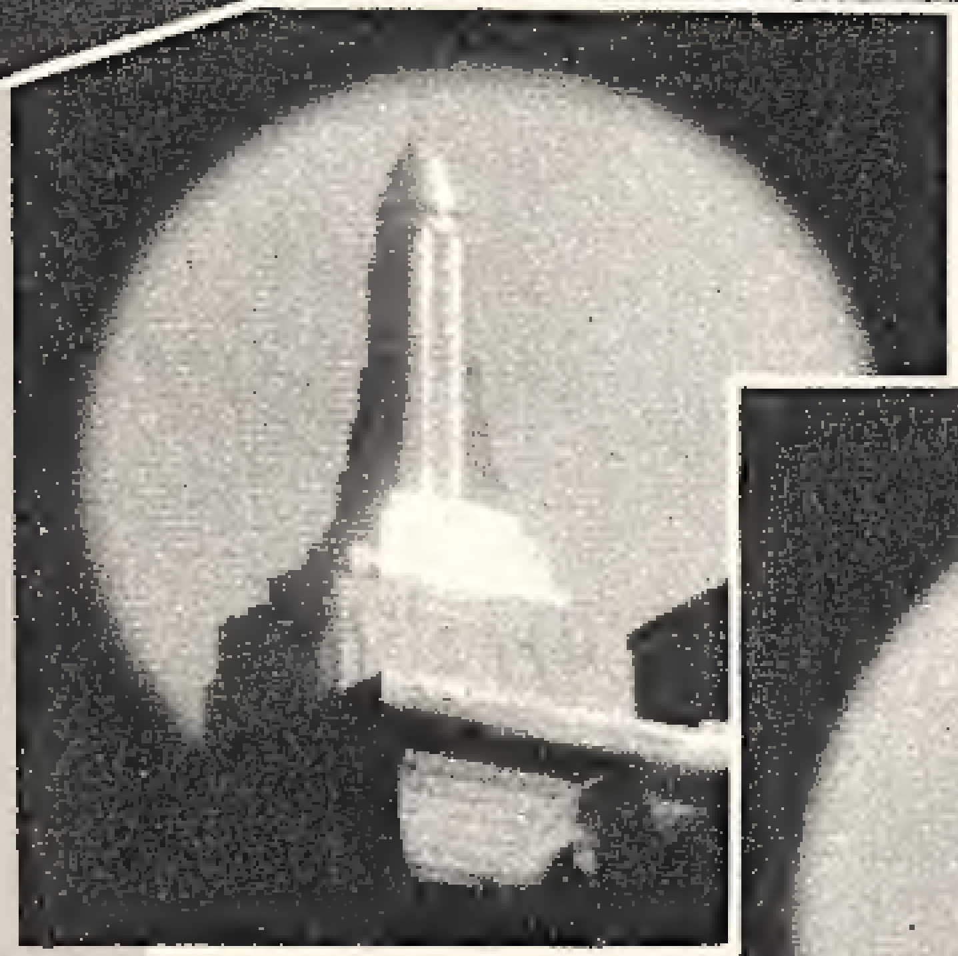
Fig. 2, left: Chemical set-up for making enlargements. Left tray, developer; center tray, acetic "short-stop" bath; right tray, hypo. Tank in back is for rinsing print tongs after prints have been dropped in the hypo. Safelight is fitted with "OA" yellow filter.

by
A. J. Lockrey

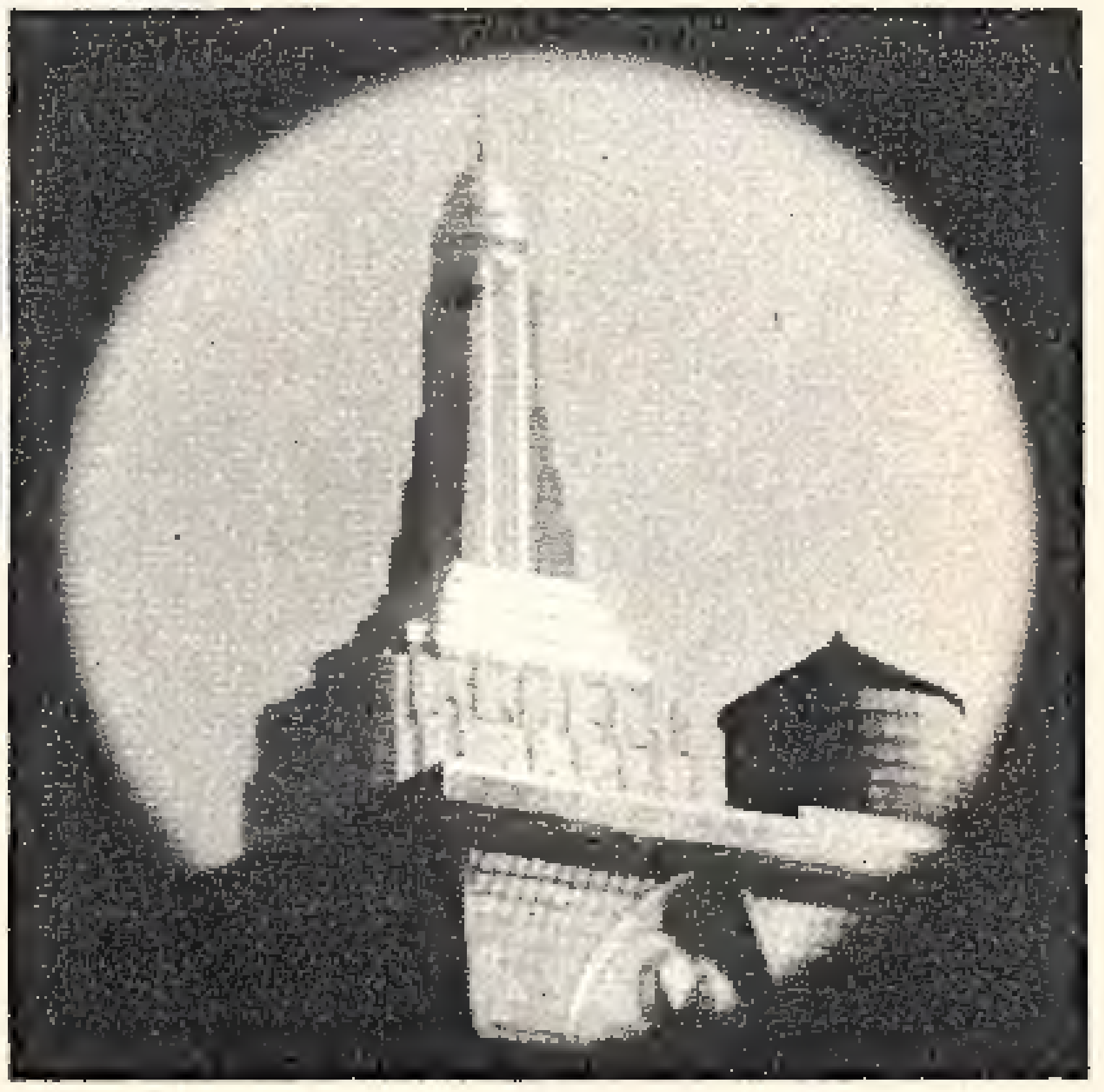
TRICKS WITH LENSES



Above — The Empire State building tower taken with an ordinary camera on a hazy day.



Right — The same scene when taken with 3-power binoculars and a K2 filter placed before camera lens.



Right — The best photo of the three, taken by binding a 10-power navy telescope and a K2 filter over the camera lens with tape.

IT IS the purpose of this article to dispel a little of the awe and trepidation with which the average amateur approaches the subject of camera lenses and auxiliary lenses, and to show how most of the effects obtained with extremely expensive equipment can be duplicated satisfactorily with ordinary everyday lenses of various types.

There are very good reasons for the high cost of the regulation auxiliary lenses, but 90% of this goes for extreme speed, accuracy and ultra-correction which the average amateur does not need in order to achieve the effects he has in mind. Portrait work particularly, and its second cousin, table-top photography, certainly do not require speed, extreme accuracy or correction, for the reason that portraits are preferably taken with diffusers, or are diffused slightly in the printing or enlarging process, while table-top work is usually of such a nature that aberrations go unnoticed.

The commonest desire of the camera addict is to be able to work closer to the camera, for portrait, table-top or other purposes, and this requires the simplest type of auxiliary lens. Amazing as it may sound, practically any type of lens under the sun may be used for a portrait-lens, and mounted in practically any manner conceivable, at any distance from the camera, direction booklets to the contrary notwithstanding. This may sound like a very broad statement, but the photos submitted herewith prove it.

In the first series (on the opposite page) is a shot of a package of cigarettes made with a small reflex camera, with the ordinary lens as close as it will normally work. In the successive shots, the object approaches closer and closer until we have nothing but a portrait of Sir Walter, half-tone dots and all, at a distance of *two inches* from the camera.

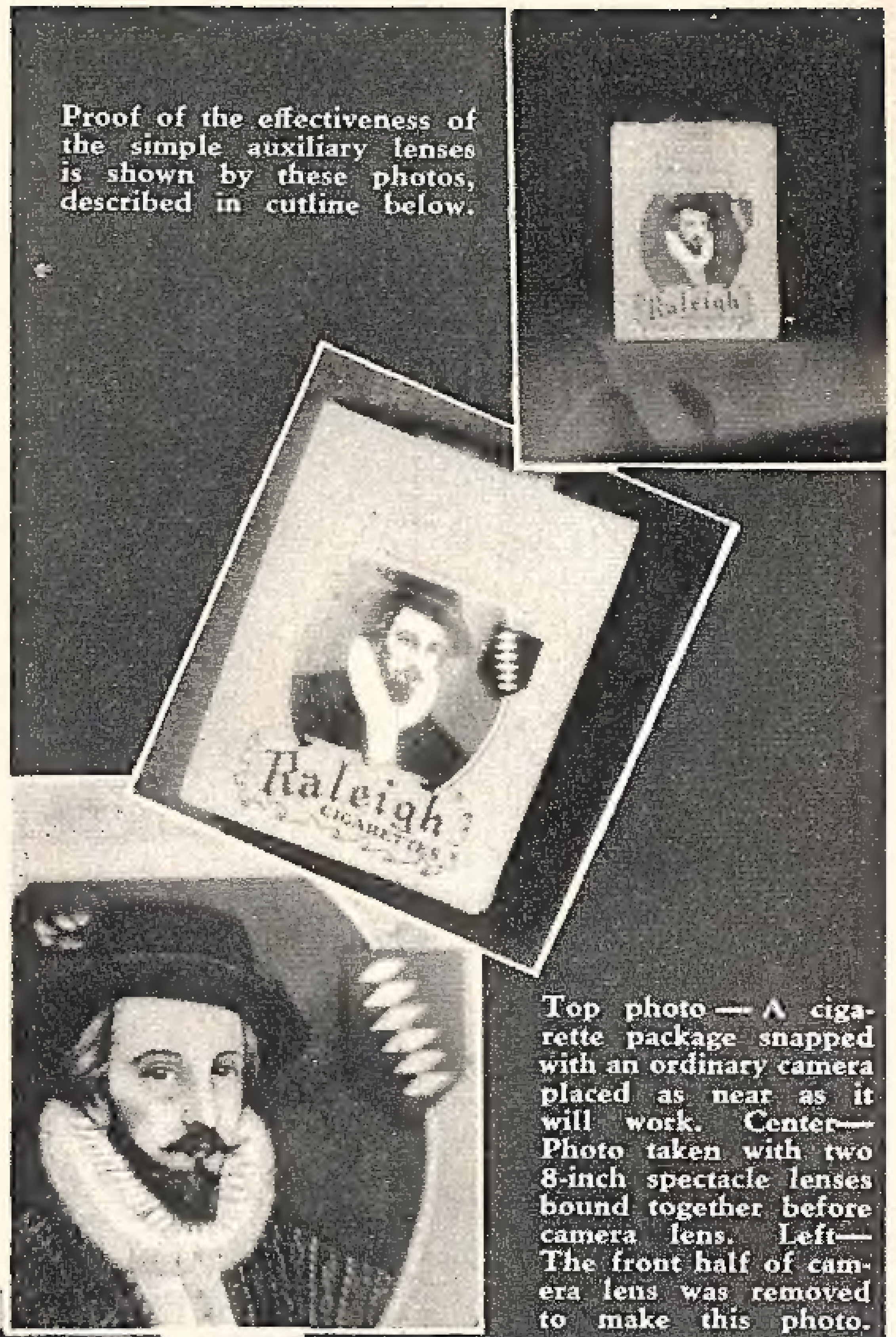
The most convenient type of lens to use for this purpose is an ordinary ten-cent store spectacle lens. These are marked with various numbers, from 8 to about 30, which refer to the focal length. From 20 to 30 is a good length for portraits, while lengths down to 8 inches or even less can be used for closer work. Lacking this type of lens, any ordinary hand magnifying-glass lens will do. These are practically all 8-inch lenses or thereabouts, and are possibly better for this use than spectacle lenses, even if not as convenient, for the reason that only the center portion of the lens is being used, which cuts out most of the aberration, although, as stated above, it is hardly noticeable.

For working at shorter distances than the lenses on hand will permit, it is only necessary to "double up," i. e., hang still another lens in front of the one you are using, or two or three for that matter. If conditions permit, the lens may be merely held up against the camera-lens by hand. If a more permanent rigging is desired, the lens may be stuck to the camera with Scotch tape, as shown in one of the photos, or a regular lens-ring may be made, of the proper dimensions for ready removal and attachment, by winding kraft-paper adhesive tape around the camera lens. Wrap the first layer with the gum side out, stick it to itself, and then wrap as many layers as needed on top of that, then bind the auxiliary lens to that ring with more tape. When this assembly dries, it will be as convenient to use as a regular portrait attachment. The supplementary lens can be mounted in direct contact with the camera-lens, or any distance away from it. The field automatically moves away from the camera the same distance, but conditions are not altered otherwise, for all practical considerations.

There is only one requirement and one caution in using hay-wire lens assemblies such as this — you must have a camera with ground-glass focusing facilities, either back or reflex such as the one pictured, as depth of focus at such short distances is extremely shallow; a quarter of an inch may throw your picture out of focus, the latitude varying with the lens stop used and the distance from the camera. If your camera is not a reflex, you can calibrate it by removing the back and attaching a piece of waxed paper, thin tissue or ground glass in the position ordinarily occupied by the film, while you focus and measure. Then, when your camera is loaded with film, you can do your focusing with a ruler. If anything other than a small flat surface is being photographed, particularly when working under two feet, it is best to stop down as far as your light and other factors will allow.

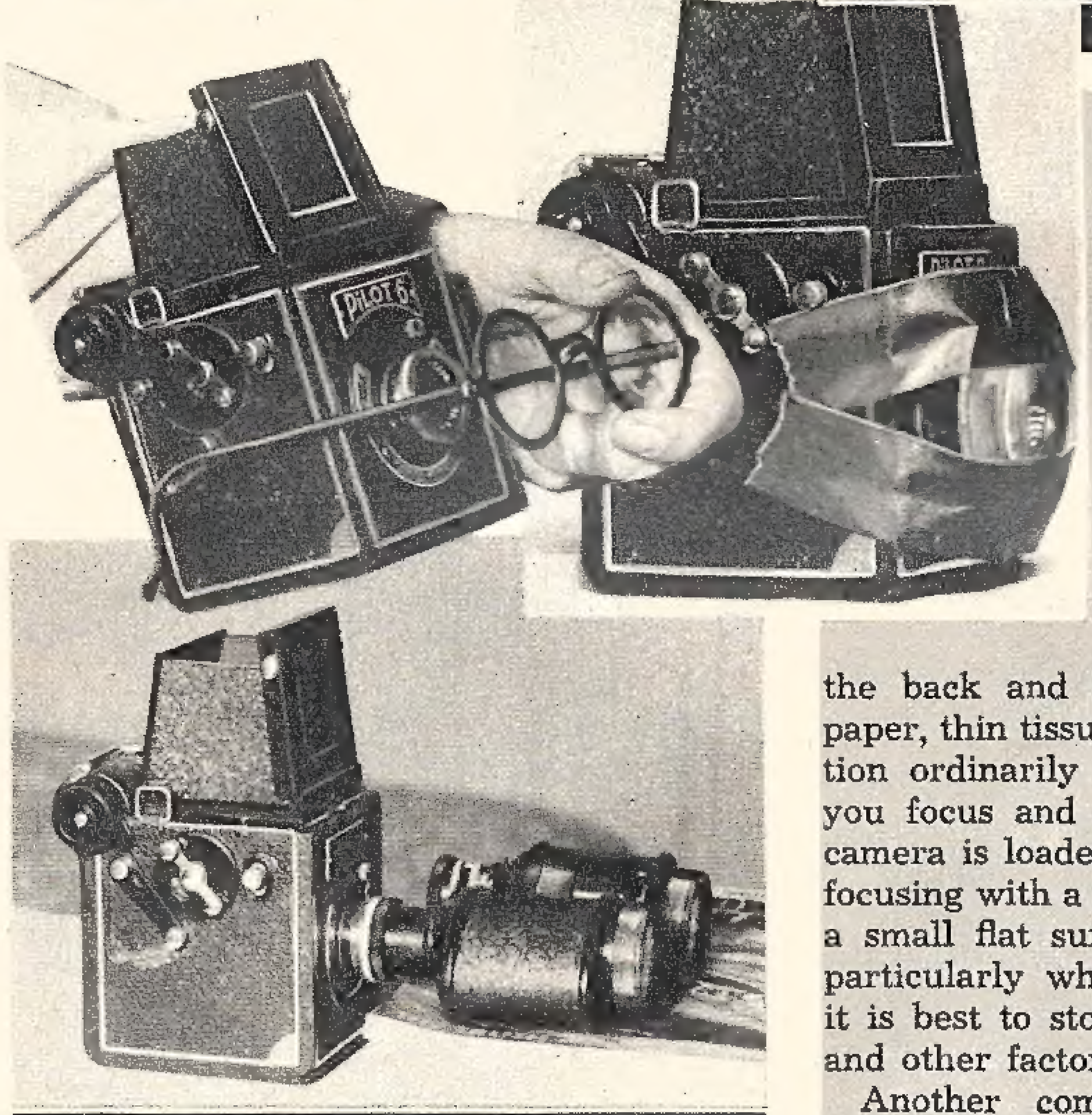
Another common method of "working close," suitable only for certain types of cameras, is to remove the front half of the

[*Continued on page* 128]



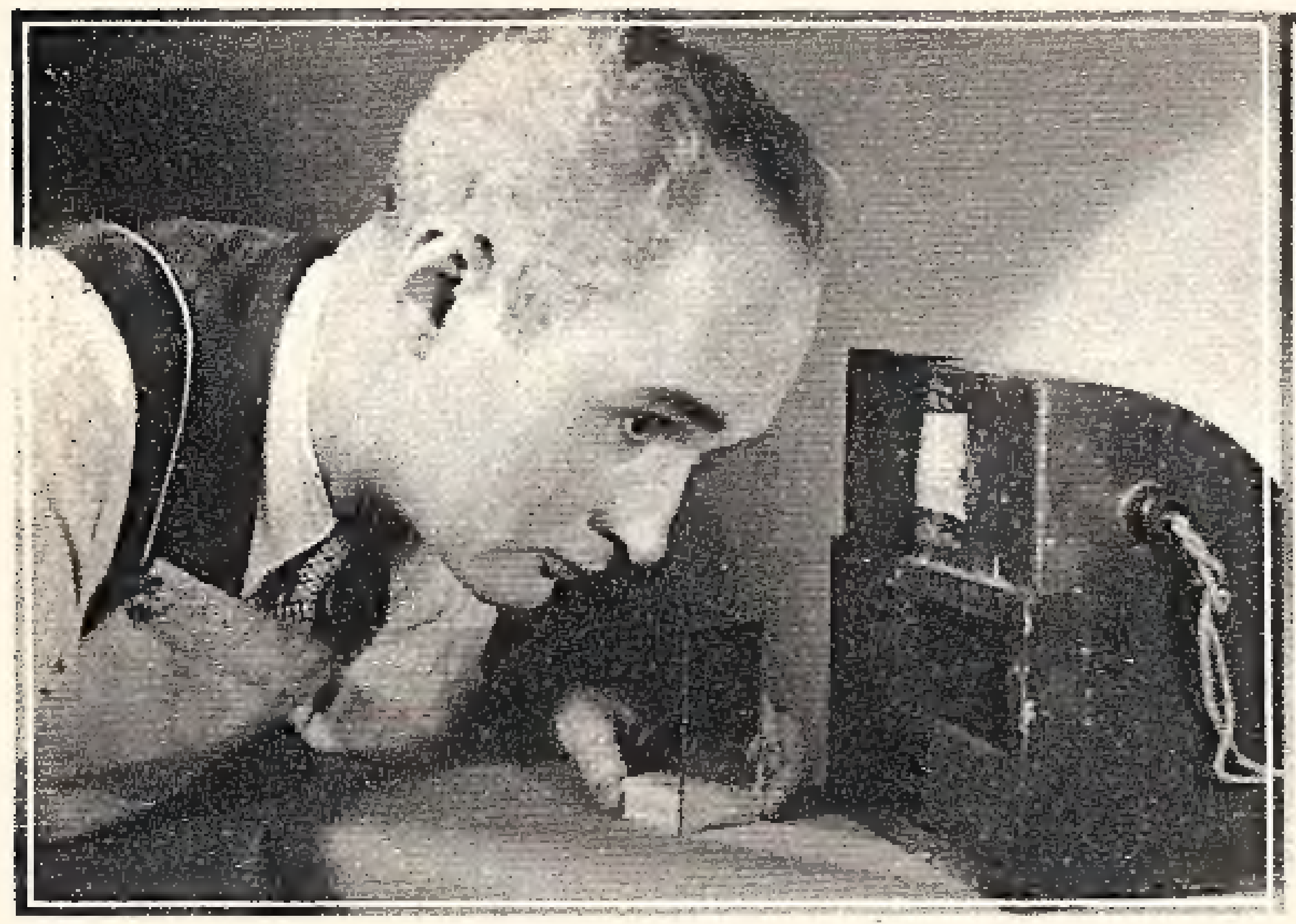
Proof of the effectiveness of the simple auxiliary lenses is shown by these photos, described in cutline below.

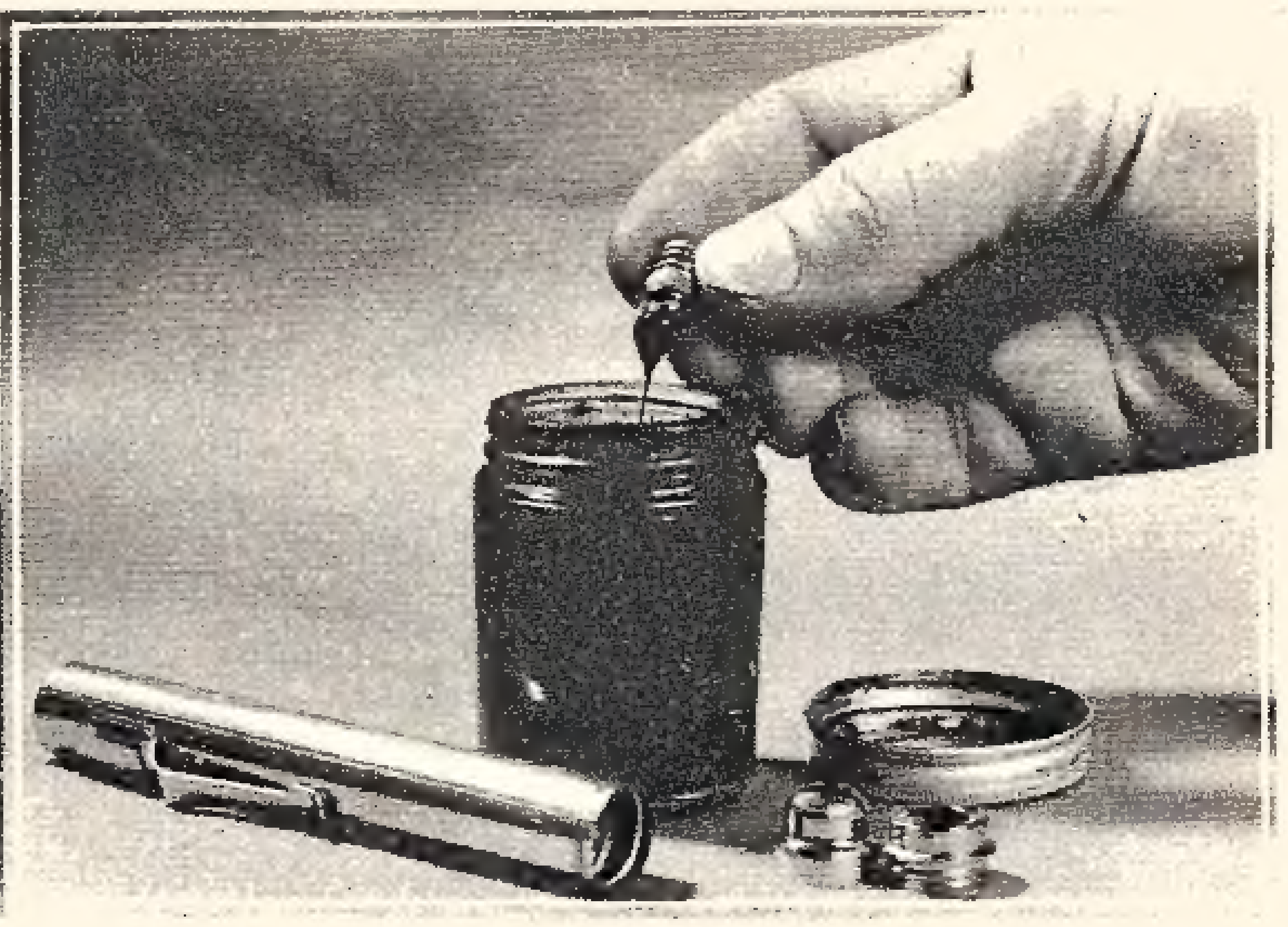
Top photo — A cigarette package snapped with an ordinary camera placed as near as it will work. Center — Photo taken with two 8-inch spectacle lenses bound together before camera lens. Left — The front half of camera lens was removed to make this photo.



Binoculars placed on a book before the camera, Grandma's spectacles held in place by hand, and an ordinary 20 to 30 focal length lens taped over the regular camera lens, as shown in above photos, serve well as auxiliary lenses.

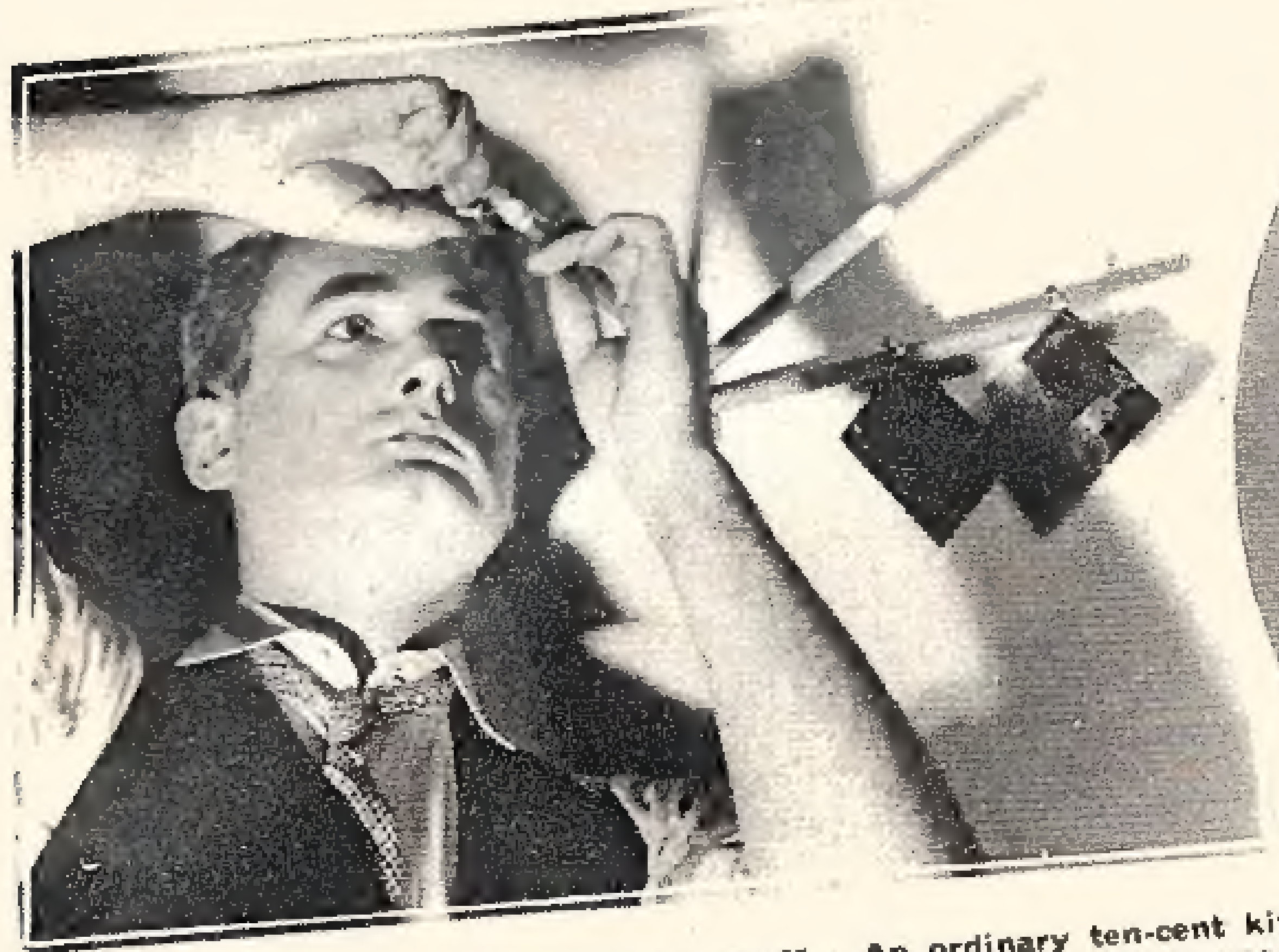
PHOTO SHORT CUTS



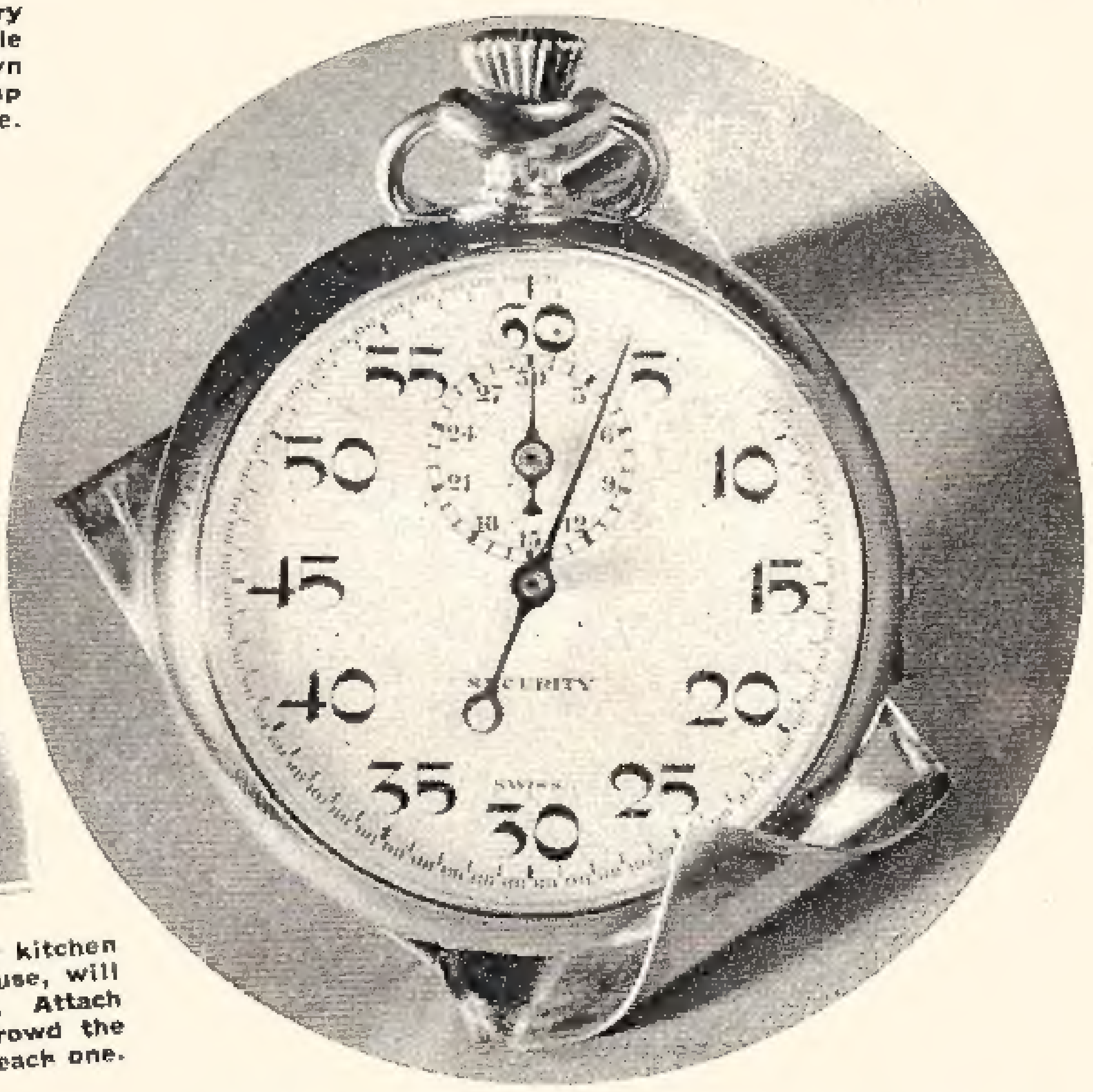


MIRROR REFLECTS LIGHT OF DARKROOM LAMP. With but one safelight in the darkroom, you can avoid carrying it about by using a small mirror mounted on a wood block, as shown above. This will reflect a spot of red light to any part of the darkroom. The angle at which to hold the mirror is determined entirely by experiment.

VEST POCKET DARKROOM LAMP. A red safelight that you can carry in your pocket is an advantage when you wish to change films while away from your own darkroom. Use a pen-light of the type shown above (right), dipping the concentrated-filament bulb in red lamp coloring, obtainable at any neighborhood electrical supply store.

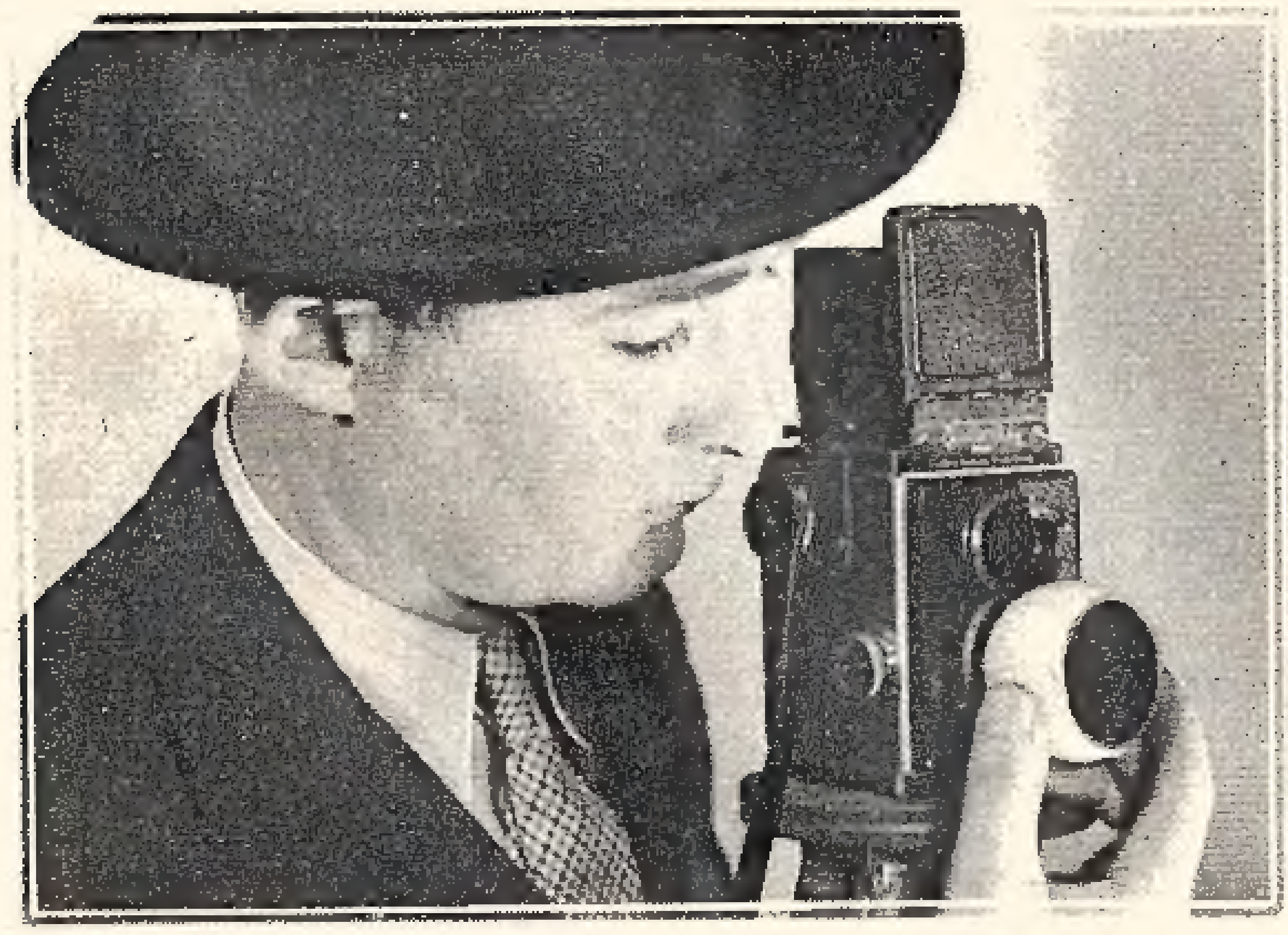


HANGER FOR DRYING CUT OR ROLL FILM. An ordinary ten-cent kitchen towel holder, which fits conveniently against the wall when not in use, will hold a dozen or so films while they are drying, as shown above. Attach each film to an arm of the holder with a push-pin, but do not crowd the films as they will dry more quickly if air can circulate freely around each one.

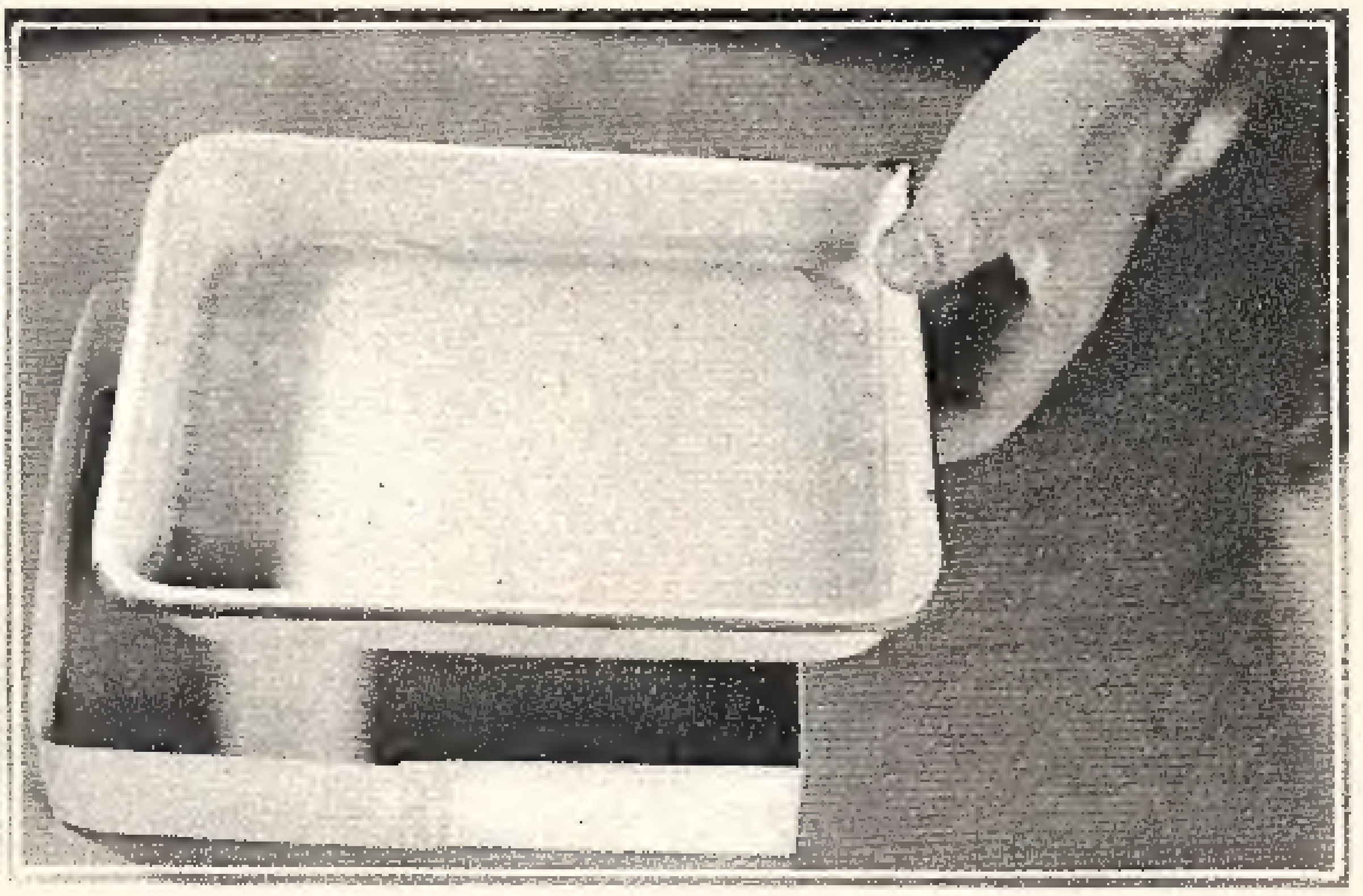


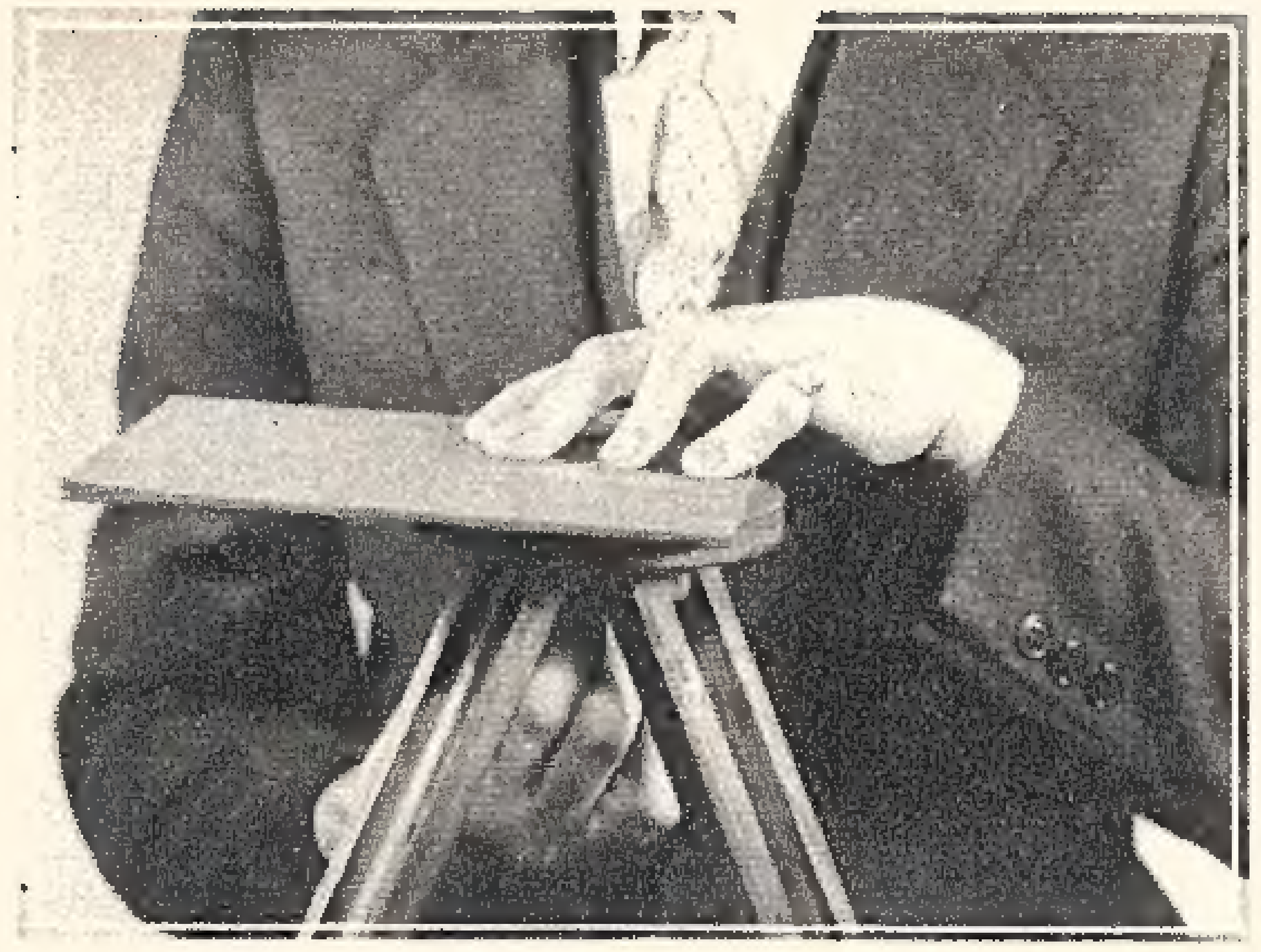
INDICATOR FOR DARKROOM WATCH. Point one end of a small strip of tin, bending the point over so it touches stop-watch dial (circle). Turn watch until the tin point rests over the number of seconds required for your enlarging job.

UNBREAKABLE LENS SHADE. Secure a five-cent rubber ball and cut an opening in one side for the lens and a larger opening on the other side. Blacken the inside completely with wallboard paint (below).

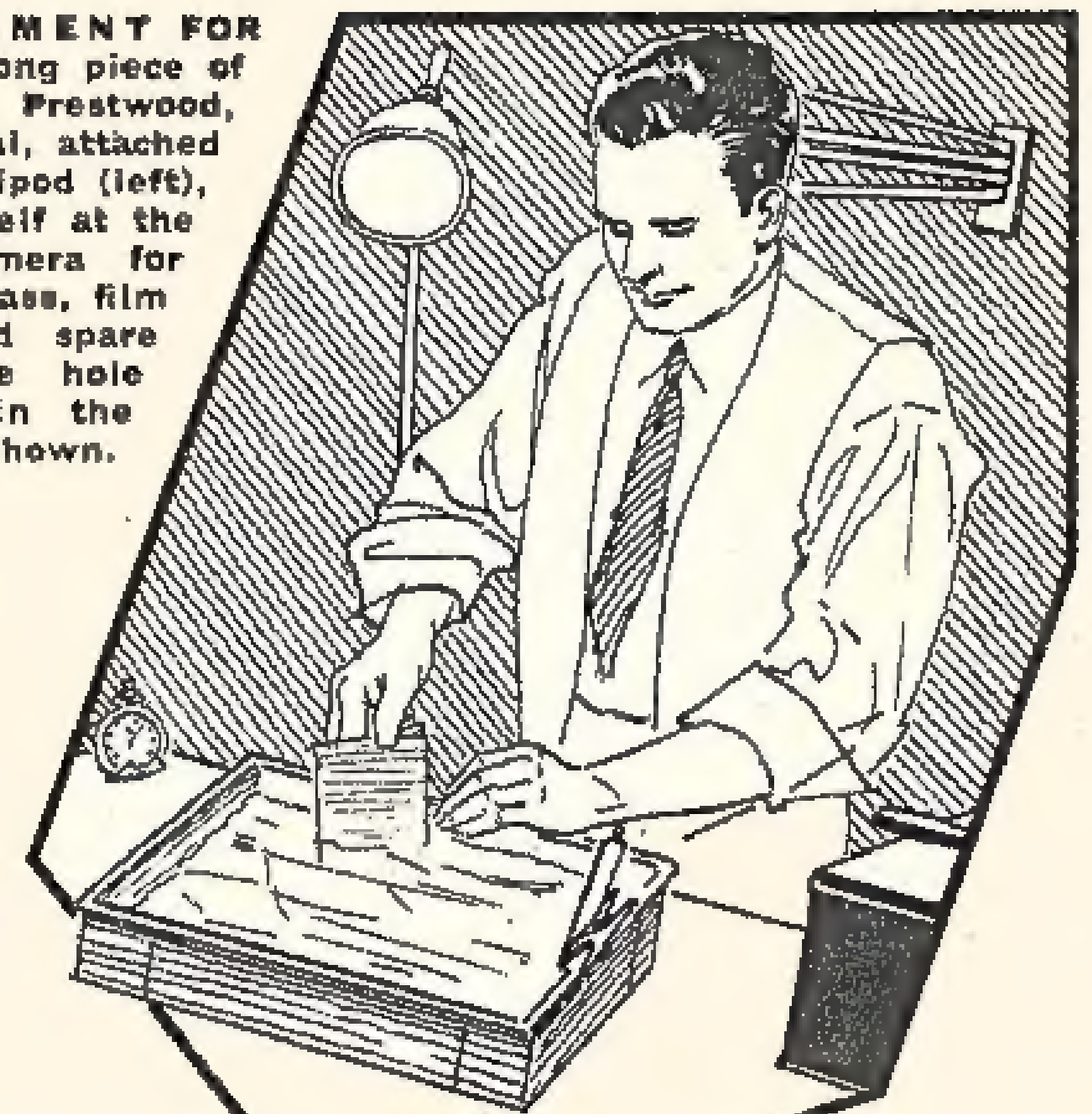


CARDBOARD STRIP KEEPS DEVELOPER TEMPERATURE EVEN. A piece of cardboard, placed under a tray of developer solution, will help to keep the developer temperature even by eliminating contact with table or bench (below).

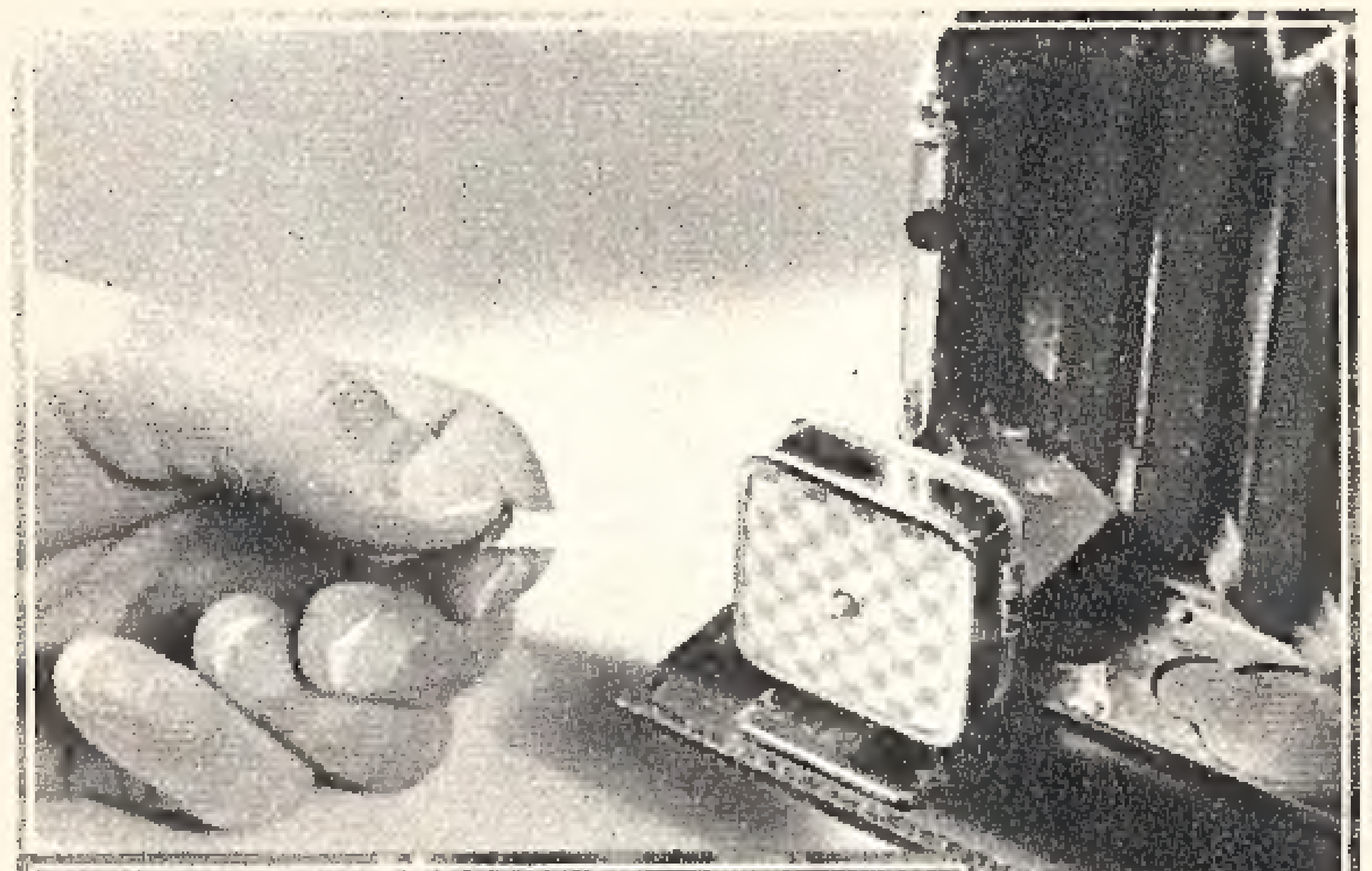


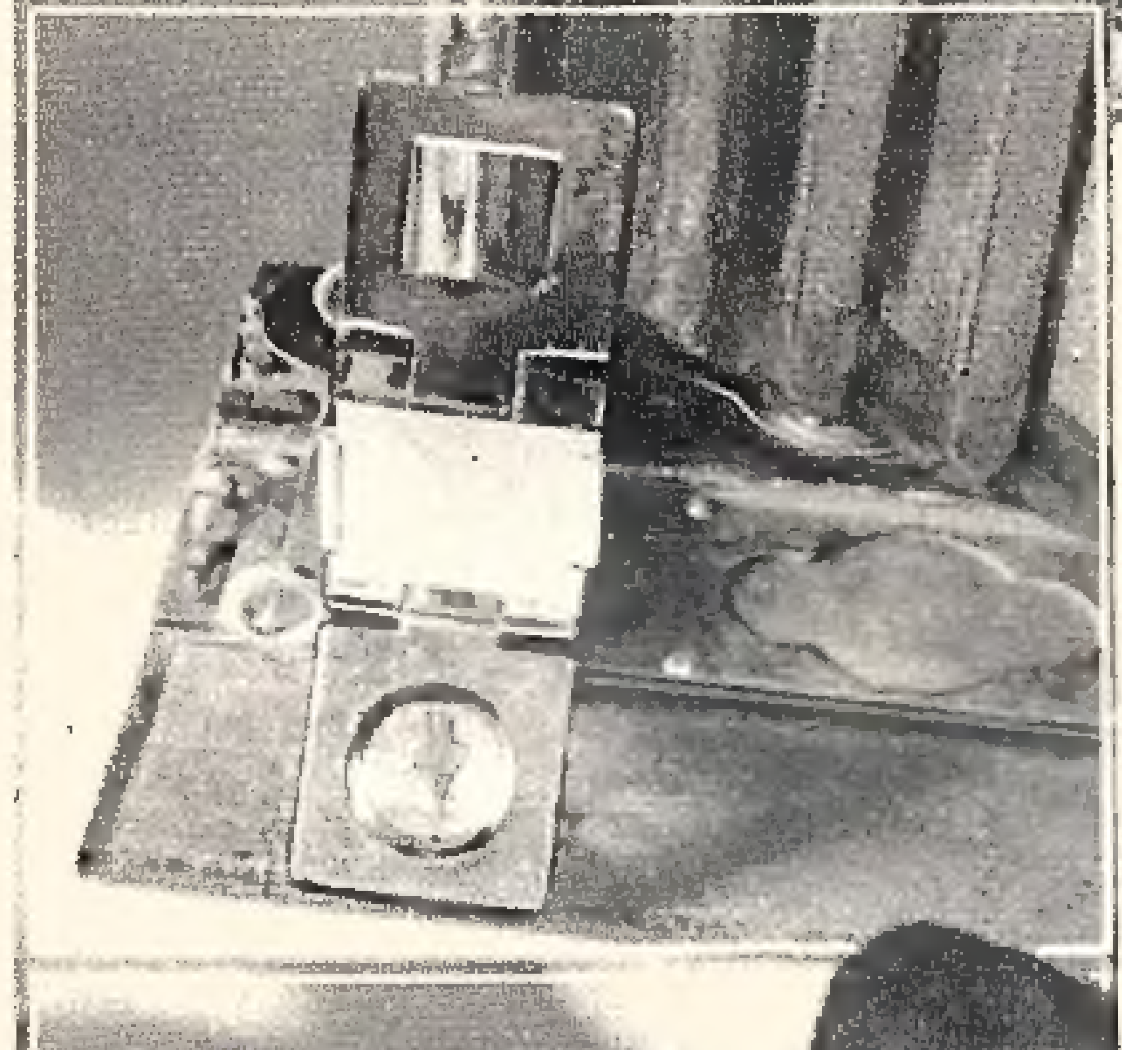


SHELF ATTACHMENT FOR TRIPOD. An oblong piece of one-quarter inch Prestwood, or similar material, attached to the top of a tripod (left), will provide a shelf at the back of the camera for holding ground glass, film pack, slides, and spare parts. Only one hole need be made in the small shelf, as shown.



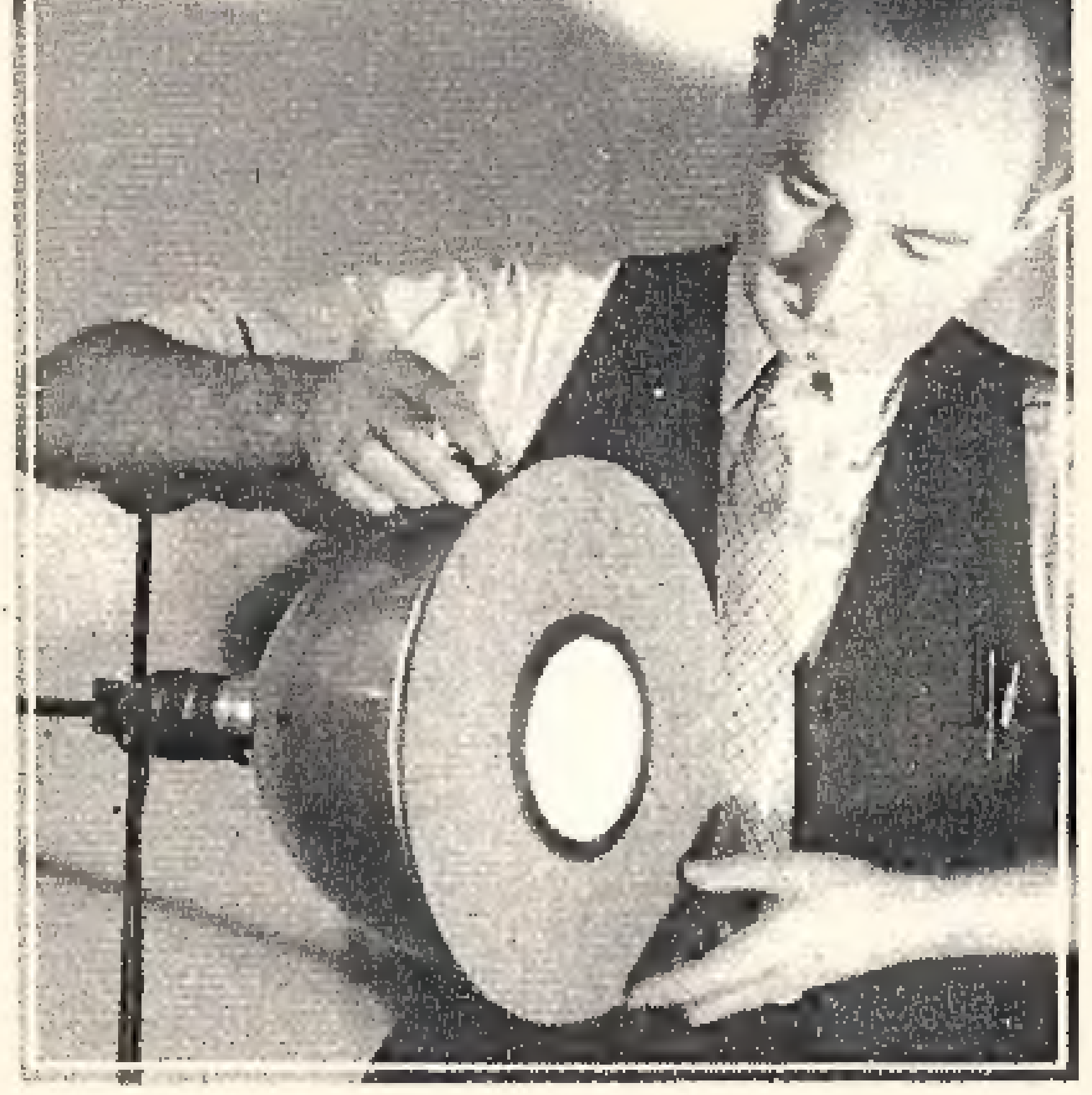
CELLOPHANE PRESERVES DEVELOPER. Use adhesive tape to hold a piece of Cellophane tightly around neck and cork of a bottle of developer to keep out air and dust (above).





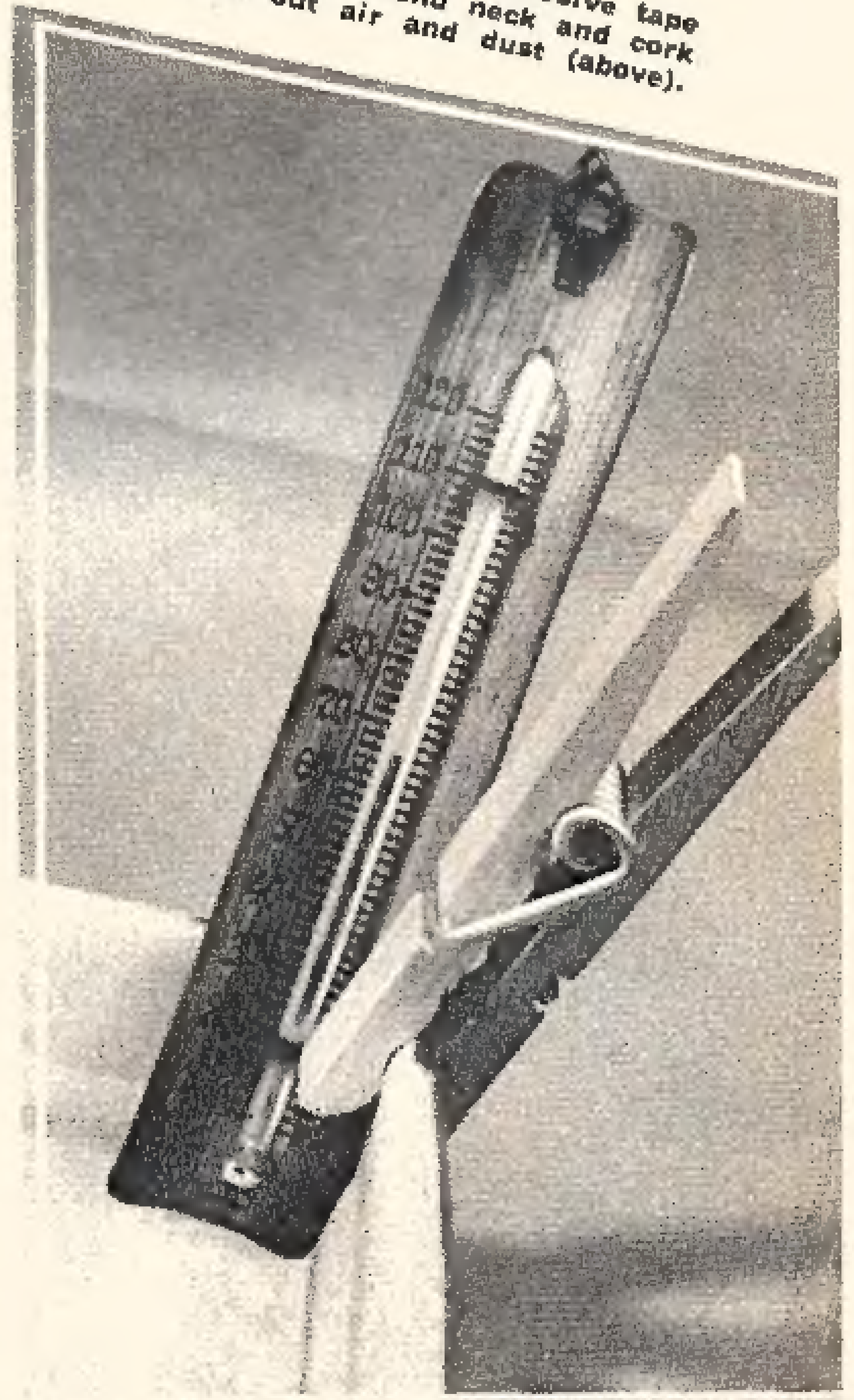
TAPE MEASURE AIDS IN FOCUSING. A spring-type tape measure (above, left) clipped to the front of a camera so that the case is on the same plane as the lens will enable you to take advantage of auxiliary lenses for copying and portrait work by providing method of measuring distance from the lens to the object being photographed.

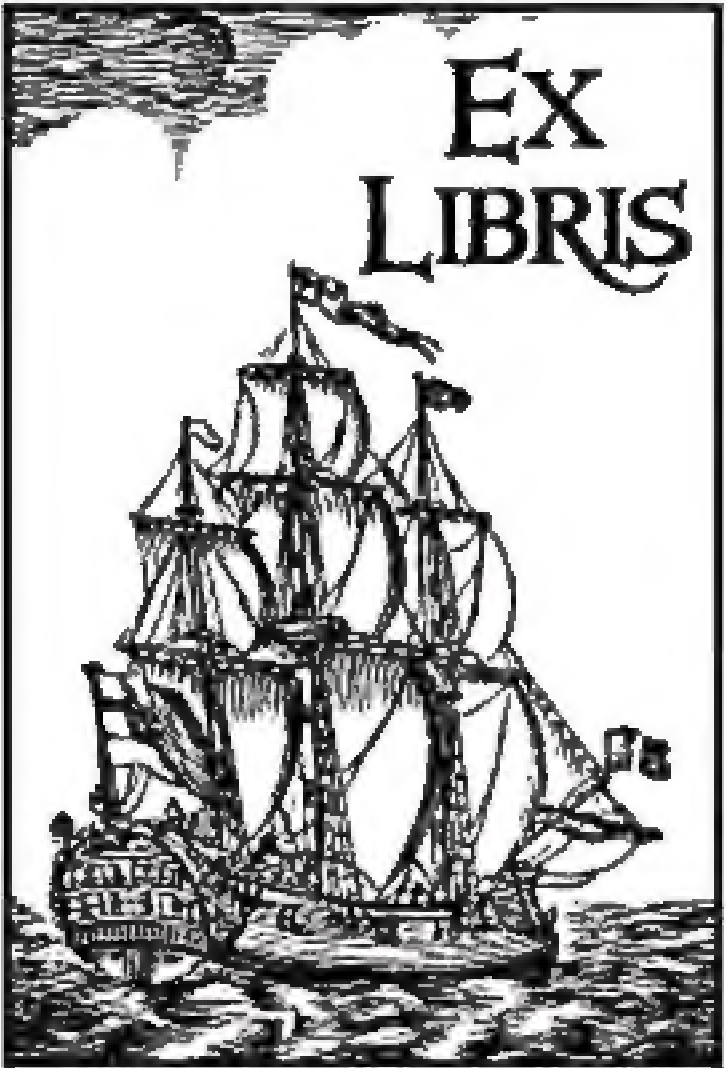
MAGNIFIER AIDS IN READING DISTANCE GAUGE. A small magnifier attached to front of camera with metal clips shows the figures and pointer greatly enlarged, as shown in photograph at the left.



CONVERTING A FLOOD LAMP INTO A SPOTLIGHT. Cut a baffle from a piece of ¼-inch Prestwood, placing bolts at the edges for hooking it over flange of flood lamp reflector. Cut a hole in center to accommodate a five-inch condensing lens and mount the latter, with convex side out, by means of Prestwood rings glued in place (left).

CLIP ATTACHES THERMOMETER TO TRAY. Waterproof a spring-type clothespin by dipping it in hot paraffine and use it to attach a thermometer in one corner of the developer tray, providing a means of checking temperature accurately.





Anon. Malefactor